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THE FALK CO'S PLANT, MILWAUKEE, WIS.

POWER IN A MODERN STEEL FOUNDRY AND MACHINE SHOP

By C. A. TUPPER

IN A visit to the largest steel foundry of the West, for the making of general castings, viz.: that of The Falk Company at Milwaukee, Wis., one finds many features of special interest—above all the economical arrangement and operation of the works, which, although complete in every detail, have nothing in their equipment or conduct not essential to the best results and are so designed as to eliminate any unnecessary handling of material.

While the business of the Falk Company started

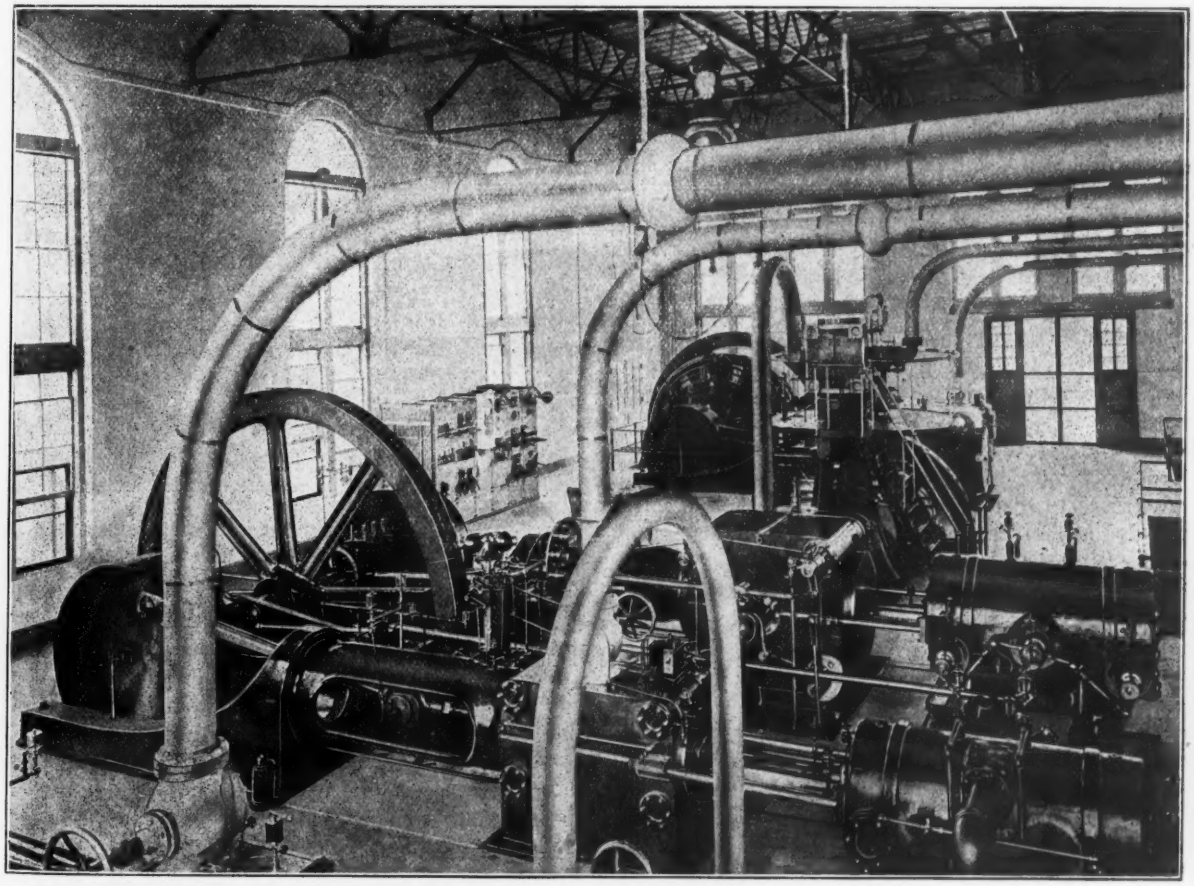


FIG. 3. POWER PLANT OF THE FALK CO., MILWAUKEE, WIS.

in an establishment devoted especially to the manufacture of street railway motor gears and track appliances, and that department still constitutes an important one, the attention of a visitor is directed particularly to the foundry and power plant, the former a building 625 ft. long by 295 ft. wide at its largest part, of brick and steel construction, having a capacity of 1500 tons monthly, where steel castings of any size required up to 40 tons capacity or more and varying widely in character, are turned out as readily as is usual in the work of a smaller plant devoted to a standard line of apparatus.

Pig iron is brought in over the C., M. & St. P. Ry.

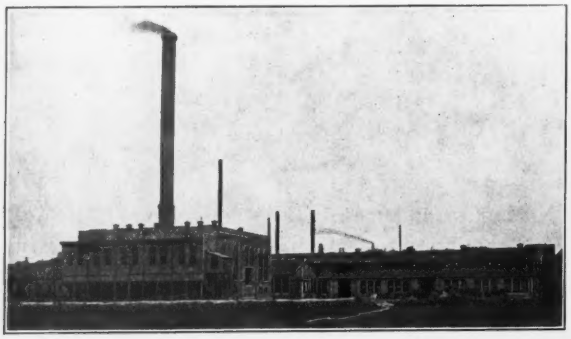


FIG. I. PARTIAL VIEW OF FALK CO.'S WORKS

and unloaded by means of a Cutler-Hammer 2-ton lifting magnet into piles between the tracks. After analysis, the pig iron and scrap are taken by the magnet in proper proportion and discharged into buckets which are carried on the industrial railway tracks. After passing over a Fairbanks-Morse scale the buckets are drawn to the charging floor of the furnaces and set into the acid open hearth furnaces.

Oil which is used as fuel in the furnaces is stored in three underground steel tanks placed in a concrete vault and holding 15,000 gal. apiece. The mixed air and oil are pumped to the furnaces and efficiently used.

From the tilting furnaces, the liquid metal is taken by four 30-ton oil heated ladles and carried by traveling cranes to the various parts of the foundry where the castings are poured through taps in the bottom of the ladles. Core ovens, a core room, sand storage bins and other fittings of a foundry are provided opposite the furnaces. To transport material about the foundry, 8 large traveling cranes built by Pawling & Harnischfeger are provided, 2 having an 80-ft. span with a capacity of 50 tons each, 5 being 50-ft. cranes with 30 tons capacity, and 1 a 25-ft span with 10 tons capacity. The various foundry floors are provided with molding machines, pneumatic hoists, cutoff saws, sand shakers and tumbling barrels as necessary. Careful attention is given to keeping the molds in order, the patterns properly numbered and stored and customers' orders in shape so that no mistakes can occur.

Development of the Business.

The Falk Company started on its present site in 1899 with a plant covering less than a quarter acre. The works have grown until they now cover 50 acres, including a covered floor space of nearly 10 acres. Among the conditions that have contributed to this rapid expansion are a system of works management which provides for the training of the great majority of the skilled workers of the plant to the positions which they now occupy. The men in authority are leaders rather than drivers, and endeavor to create an atmosphere of loyalty and discipline by kindly control, which inevitably brings good results.

Mr. Herman Falk, the president, is himself constantly about the plant, often in company with Mr.

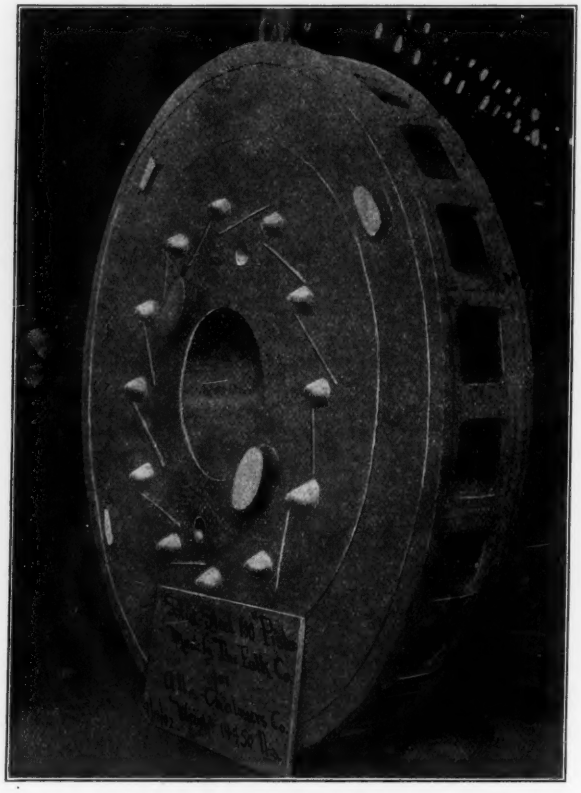


FIG. 2. ONE OF THE FALK CO.'S PRODUCTS

Clarence Falk, the work's manager, and both of these officials take the greatest personal interest in every operation and are acquainted by name with nearly every individual of the large army of workmen. When any change is proposed in a method or system, all those who are most experienced in that particular line of work are called in and all arguments for and against the change are carefully weighed and considered.

In all purchasing of equipment or supplies the suitability of machinery or material to the requirements is kept in mind quite as much as the price. For instance, generating and air compressing equipments and

other machinery about the plant are the best that money can buy for the purpose, and under the boilers a good grade of Youghegheny lump coal is used. When coal is delivered to the buckets a sample of each lot is taken to a special bin and tested under normal conditions so that the exact value to be expected from every load becomes a matter of record. Physical and chemical analyses are made of the coal and the heat units per dollar of cost are carefully checked. Records show that this coal gives more heat units per dollar than

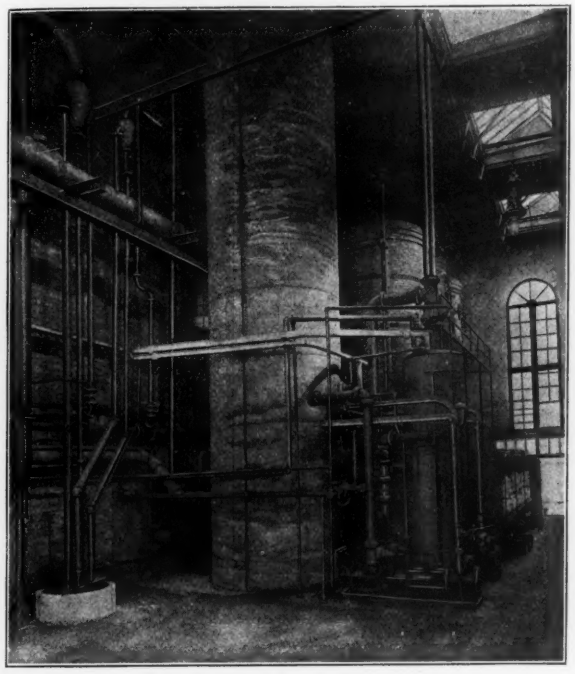


FIG. 4. BOILERS, STACK, HEATER AND CONDENSERS IN FALK CO.'S BOILER ROOM

any other grade thus far tried. The same careful system of specification and analysis is followed in the buying of iron, oil, linings, facings, and other material used in large quantities. The line of product turned out by the company consists of steel castings of all descriptions, particular attention being paid to cast steel gears and forged steel pinions for street railways, to frogs, switches and special forgings and castings for track work, and special castings which have been given up by other foundries. By careful attention to the quality of products at all points the company has built up a reputation which is widespread and which is among the largest and the most particular users of steel castings.

Power

In the entire works of the company, all of the machinery which does not take compressed air, is electrically operated, principally by individual motor drive, although short lines of shafting are used in such places as the pattern shop, cleaning department of the foundry, etc. where numbers of light running machines make this arrangement the most advantageous. Electric current and compressed air are supplied from a new central power station which is one of the most interesting features of The Falk Co.'s works.

Neatness, orderly arrangement and absence of a large percentage of the usual quantity of piping, are points which strike the visitor's attention immediately upon entering; but, as the station design is followed out it soon becomes apparent that these are only an index to the general character of the plant, which was equipped, in all of its main details,—engines, generator, compressors, circulating pumps, etc.,—by Allis-Chalmers Co., of Milwaukee.

Engines

The machinery consists of a cross-compound condensing Reynolds-Corliss engine, with cylinders 20 and 42 by 42 in. stroke, operating at 100 r. p. m. and coupled to a generator of 550 kw. capacity, delivering direct current at a terminal pressure of 250 volts; an 18 by 24 in. simple condensing Reynolds-Corliss engine of the vertical pattern direct connected to a 125 kw. generator with characteristics similar to the larger machine; and 2 air compressors, one 2-stage and the other single stage, having capacities of 2500 and 1800 cu. ft. of air a minute. The steam end of each unit is an engine of the same type as that driving the main generator, and the air cylinders are of Allis-Chalmers Co.'s standard construction. For the rods and valve stems of these machines Cook's metallic packing is used.

Richardson sight feed oil pumps lubricate the cylinders of the engines and the gravity system is used for all the units; oil flows, after use, to a 5-chamber Turner filter in the basement and is pumped back to a 200-gal. tank located under the ceiling of the engine room by means of a 4.5 by 2.75 by 4-in. pump of the Platt Iron Works type. The capacity of the system is 450 bbl. daily.

Steam Generation and Control

In the steam generating room are three Wickes vertical water-tube boilers designed for a working pressure of 150 lb. and rated at 300 hp. each, with furnaces and grates of the same builders' standard construction These boilers are connected to a 12-in. header, which divides into 6-in. feeders serving the several engines. Steam is supplied at 50 lb. pressure through large separators connected with Squires traps.

The piping, erected by the Pittsburg Piping & Equipment Co., is of extra strength. Elbows were dispensed with as much as possible and long turn bends used instead, those on the steam feeds to the engine being bent to a 6-ft. radius. Crane valves, with rising stems, are employed throughout and there is a very complete system of steam, water and air control, which can be operated from either the engine or boiler room floors, thereby insuring prompt shut-off in case of accident.

Boiler Feed

All water for boiler feed is taken from the city mains and first passed through the jackets ad inter-coolers of the air compressors before flowing to an open Crawley heater. Thence it is lifted to the boilers by one of 2 Burnham outside-packed plunger pumps, each 14 by 8 by 16 in., of the Union Pump Co.'s design, the second unit being held in reserve. There is also a 7 by 4.75 by 8-in. Prescott pump, used to work the turbine flue cleaner and for boiler washing.

The Crawley feed-water heater and purifier consists essentially of an outer and an inner shell inclosing a steam jacket. The water is heated by passing over a series of removable pans, and then drops into a combination receiver and settling chamber, where additional heat is supplied by contact with the inner shell which separates the receiver from the steam jacket. Oil separation takes place in the steam jacket. Access to the heater is obtained by means of a hinged door and a manhole.

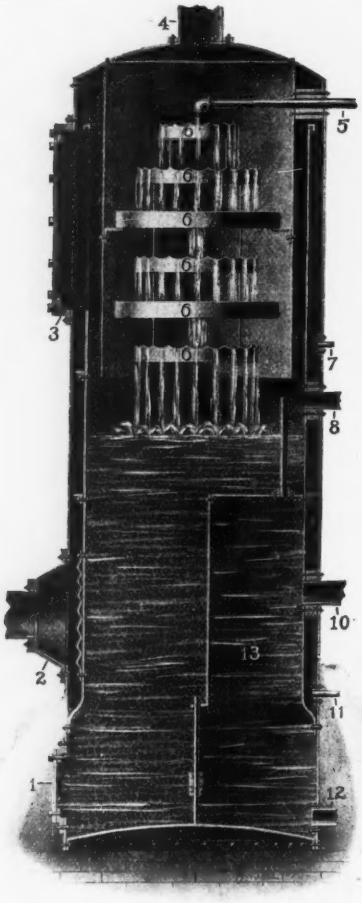


FIG. 4A. SECTION OF CRAWLEY OPEN FEED-WATER HEATER

Only half the space in the boiler room is at present occupied, and reinforced concrete foundations have been laid for another battery. In the engine room a rearrangement of the units can also be readily made to provide for additional capacity.

Each furnace has independent dampers between it and the breeching, which connects with a reinforced concrete stack 180 ft. high, having natural draft through an 8-ft. flue. The main damper is controlled by a Richard Thompson regulator operated from the engine room.

Tomlinson Condensing System

Each of the engines is connected to 1 of 4 Tomlinson barometric condensers built and installed by Allis-Chalmers Co. The water flows from a nearby river to a deep well, where it is elevated to the condensers by means of Allis-Chalmers steam-driven centrifugal pumps, 1 pump supplying 2 condensers. The latter

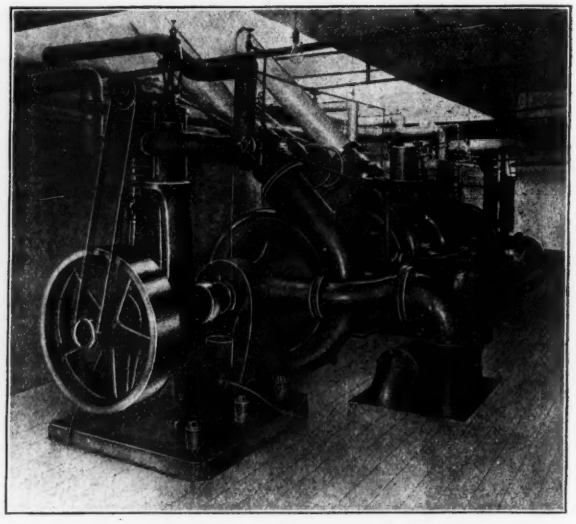


FIG. 5. CENTRIFUGAL PUMPS FOR CONDENSING WATER

are equipped with equalizer pipes, thereby maintaining a uniform vacuum on the different units. The suction pipes to the centrifugal pumps are provided with sliding screens, which can be taken up at will, insuring a free intake to the pumps at all times. There is also a third Allis-Chalmers centrifugal pump which is used to remove any accumulation of mud in the bottom of the well, and which may be used to pump water from the deep well through the jackets and inter coolers of the air compressors and to supply the heater for boiler feed in case of failure of the city mains.

The exhaust of the auxiliaries goes to the Crawley heater, to which all traps also discharge. Coal is brought in on an inclined track and dumped over enclosed bunkers having a capacity of 400 tons, the cars being pulled up by means of an electric hoist. As the bottom of each bunker is pitched toward the furnaces, this arrangement puts the coal from the car to the furnace door practically without shoveling.

Generator

The main generator furnishing direct current is of Allis-Chalmers Co.'s standard design for general power

service. It has a yoke divided horizontally, permitting easy removal if required, and the field cores are of cast steel, with laminated pole faces, so secured by countersunk screw bolts as to enable the individual poles to be separately removed and the field coils changed or minor repairs made without affecting the rest of the machine. The armature is of open construction, affording a free passage for the air, which circulates through the body of the core and the radial ventilating ducts; and the coils are of the form-wound interchangeable type. Good commutation is a feature particularly observable in the operation of this machine.

The switchboard was built by Geo. F. Rohn, of Milwaukee, and equipped with standard apparatus, including the Cutler-Hammer switches.

The distribution of current to the shops is through insulated underground cables, which feed a network of wires run in iron piping to the various departments where power is needed.

The plant is thoroughly equipped with modern appliances for conducting efficiency tests and gathering daily records, all of which are kept in constant service, by H. J. Mistele, chief engineer of the power station, and this has a very appreciable effect upon the operating economy.

The officers are Herman W. Falk, president; Otto H. Falk, vice president; Charles L. Jones, second vice president; E. A. Wurster, secretary and treasurer; Clarence R. Falk, works manager; Harold Falk, general superintendent, and W. Frank Carr, chief engineer of works.

PIPE FITTING FROM AN ENGINEER'S VIEWPOINT

KINKS ON MAKING UP AND CONNECTING IN HEATING COILS

By H. H. Yates

OF THE many duties which fall to the lot of the engineer in the moderate and small sized manufacturing plant, that of caring for and installing steam piping is about the most difficult and trying, particularly to the man just taking charge.

A heating system with which I am familiar, was installed, according to report, by a wandering fitter who, on the same authority, was chiefly engaged in making the job last, and incidentally unloading numerous "schooners."

The fact that he was considered a good one making it very difficult for the engineer to suggest changes or improvements, the engineer in charge at the time either could not, or would not, interfere, so several bad arrangements of pipes were made, which later fell to my lot to change.

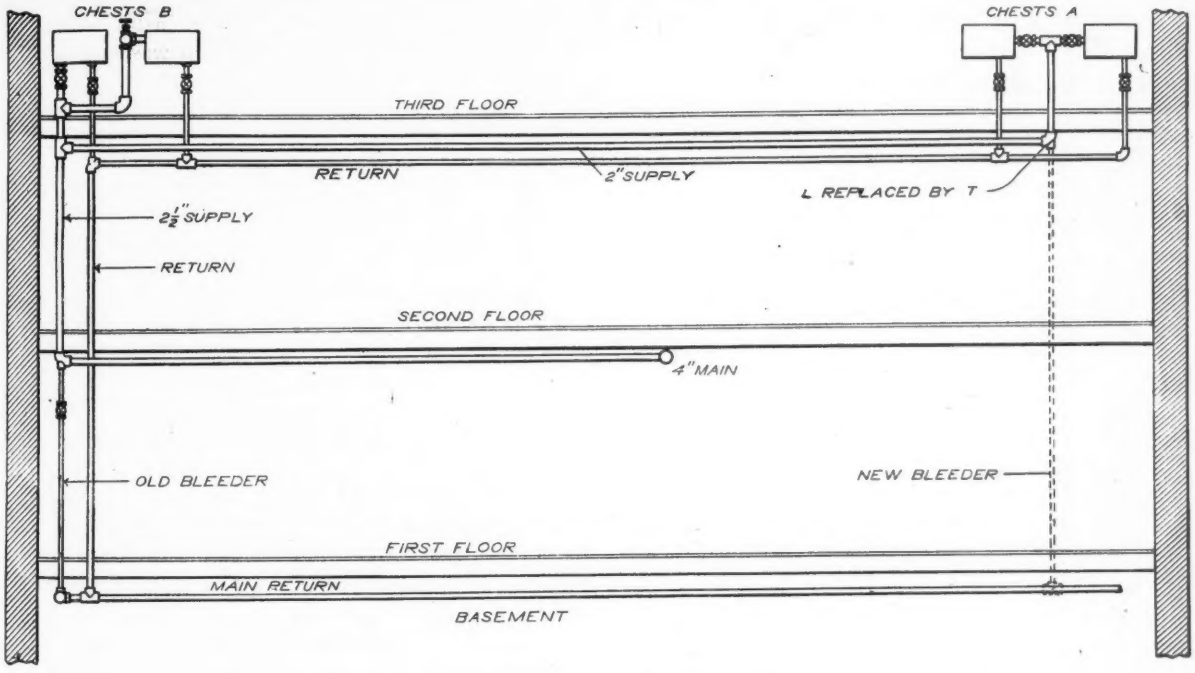


FIG. I. CONNECTION OF THIRD FLOOR STEAM CHESTS WHICH GAVE TROUBLE

Having entered upon my new position in the spring, I was fairly well acquainted with the piping before cold weather arrived, for, although many of the pipes and coils are used all the year, the serious defects did not show up until cold weather made the condensation greater. I might state at the beginning that, with the exception of 2 short lengths of 4-in. and 2½-in. pipe in cold places, all of the pipe was bare,

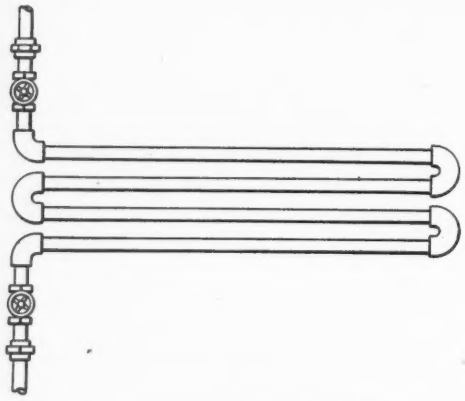


FIG. 2. IMPROPER PLACING OF UNIONS

and the loss due to condensation can well be imagined. I have since covered about 900 feet of from 1½ to 5-in. pipe with beneficial effect.

Difficulty From a Water Pocket

One of the first difficulties I met was getting steam to 2 steam chests, which are used by printers, situated

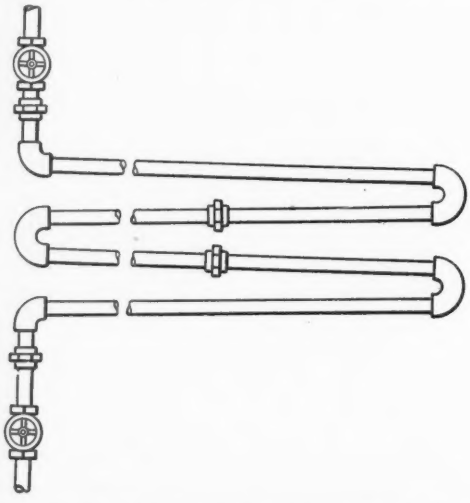


FIG. 3. VALVES AND UNIONS PROPERLY PLACED. PIPE INCLINED TO IMPROVE DRAINAGE

on the third floor of a building, about 100 ft. from the boilers, but by way of the pipe fully 3 times that distance. Fig. 1 will show the arrangement of the pipes, the direction of the current being evident from the drawing.

A and B represent the chests; the ones marked B never gave any trouble, but the ones marked A would not heat properly, and it was necessary to blow out the pipe occasionally, through an outlet to a tub, not shown.

The bleeder under the vertical pipe beneath chests B kept that part of the pipe clear, but the pipe between A and B being practically level, besides the vertical rise of about 5 ft. beneath A, formed a fine place to collect water. As there was only about 2 lb. difference in pressure between the supply and return pipes

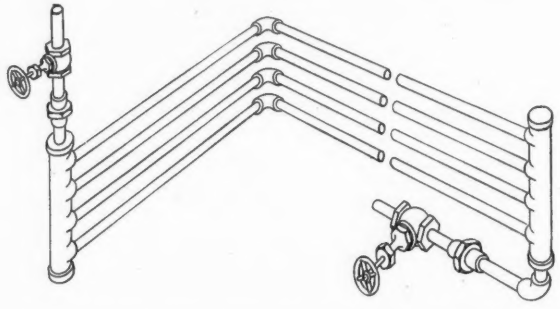


FIG. 4. CORNER COIL MADE WITH RIGHT AND LEFT ELLS

it was impossible to get rid of the water except by blowing out as before stated.

To remove this trouble, I put a tee in place of the ell beneath A and led a ¾-in. pipe, with a valve close to the tee, to the main return pipe, as shown by the dotted lines, which proved to give the necessary relief.

Later, when installing other chests, instead of ells, I put tees and plugs, the use of which was necessary

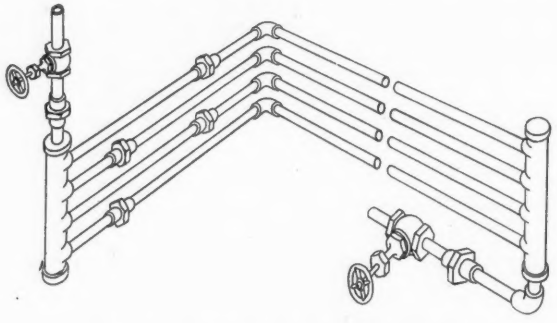


FIG. 5. CORNER COIL WITH UNIONS

a short time afterward for other bleeders. I have had to put in several bleeders at other places, besides there are several places on the main line where they should also be, but the management will not stand the expense.

Valves for Draining

While a trap is the proper way to drain a bleeder, it is rather expensive, and in some cases a valve will do if carefully adjusted and used by but one person, and that one should be the engineer. A "crack" is usually all that is required, but as this in time will cause a

valve to leak it is best to use valves of the renewable disk or regrinding type.

A bad feature of this system is that in many cases the steam supply, and drain valves on the heating coils are on different floors, that is, the supply valve is convenient, but the drain valve is located beneath the floor, and as the workman will not go down to the lower floor and climb a ladder to completely shut off the coil, the water backs up and fills the coil. Of course this cools it off and the man is satisfied, but this method is rather destructive to the pipes.

Location of Unions

A great many coils are arranged as shown in Fig. 2, with the unions outside the valves, and as repairs

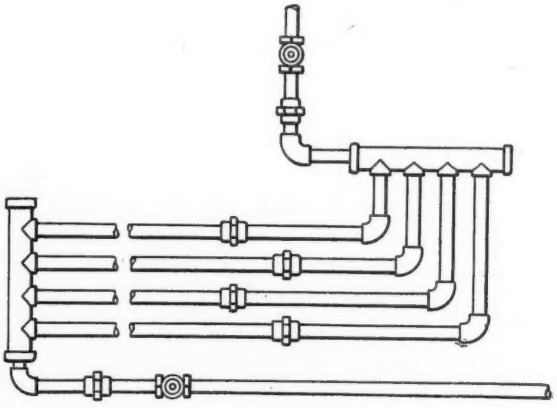


FIG. 6. SIDE WALL COIL WITH UNIONS

have to be made in close quarters and it is not advisable to shut off the main the jobs take much longer, while if the unions had been inside the valves the coil could be taken out bodily and repaired much easier.

There are also some coils like that shown in Fig. 2, that is with return bends, that contain from 200 to 300 ft. of pipe and no way of getting out a length without breaking a fitting, unless steam is shut off the main, an occasional union would obviate this, and although adding slightly to the first cost, it would be repaid when repairs were made.

Return Bends vs. Manifolds

The coil made with return bends, while possibly slightly cheaper to construct than with manifolds, is not as good when very large, as the condensation from the upper pipes nearly fills the lower ones, taking up space that should be filled with live steam and lessening the efficiency of the coil. Each pipe of a manifold coil has to care for only its own condensation. I have known of coils of the return-bend construction, the lower pipes of which were always cool and sometimes cold. By giving the single pipes considerable pitch, using single hooks, as shown in Fig. 3, the drainage is improved, but at the risk of straining the pipe where it screws into the fitting, this being naturally a weak place anyway.

Ells vs. Unions

A coil much used in rooms where it can be placed in a corner and extend on 2 sides, is shown in Fig. 4. As usually erected, right and left ells are used in the corners, these being easily handled when new.

This makes a neat looking job, but when repairs are necessary it is sometimes difficult to make a tight joint after replacing. A union in each pipe and an ordinary ell at the corner is far better and just as easily handled, the extra cost being repaid by the ease with which repairs can be made. Fig. 5 will give an idea of the way the unions should be placed. Ground joint unions should be used.

It should be remembered that I am looking at this matter from an engineer's point of view, not from the steamfitter's, for while the former who has such work to do has to save time, both in constructing the coil when new as well as when repairs have to be made, most steamfitters like a job to last as long as possible, although they may do honest work.

Making Joints

Right here is a point I want to emphasize. Always when making any kind of a joint, be sure that the joint can be parted without breaking the fitting or the man doing the repairing. Some men act as if the "dope" cost $1 a pound and they had to pay for it, others use any old thing that is handy and assists in making a tight joint, without any thought of the man making repairs.

I always use considerable graphite in making joints. Either red or white lead, with a large proportion of graphite mixed with it, is good, or even boiled linseed oil and graphite alone is good. A ready mixed preparation, consisting largely of graphite, which is manufactured by the Jos. Dixon Crucible Co., comes in friction top cans and is very convenient and economical.

Wall Coils

For straight side walls, a coil like Fig. 6 is used. As in the case of Fig. 4, right and left ells can be used, but, except in very short coils, unions are better.

In some factories, such as the potteries, it is customary to use a coil under a rack used for drying ware, a very common way being to lay coils on wedge shaped blocks, using return bends; but such coils will not give good service, if very long, as very little space is allowed, and it is impossible to give sufficient pitch to insure good drainage.

A better way is to make a coil like Fig. 7, using manifolds and unions as in the former cases. The vertical pipes should be about 2.5 ft. long to give enough elasticity to permit unions to be connected. Of course as in all good work, accurate measurements are necessary. This vertical part can be located between the supports at the end of the rack and will take no usable room. The coil can be pitched enough to give proper drainage and yet not take as much

room as one of the same capacity of the return bend type.

Drying Out Coils

When a coil is used only during the winter months, it is a good plan to put a 1 by ¼-in. tee in the drain pipe—between the valve and coil—and with a ¼-in. close nipple and valve afford a means of removing all water when shutting off for the summer, allowing the supply valve and ¼-in. valve to remain open for a few minutes will thoroughly dry the coil and save pipe and labor.

This ¼-in. drain can be arranged to discharge into a pail or, if possible, can be extended through the

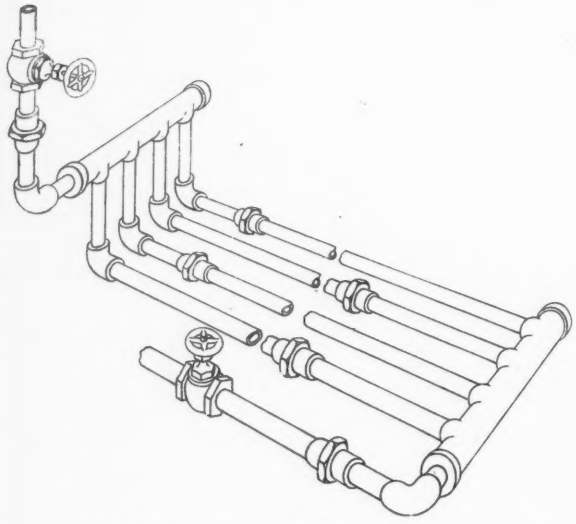


FIG. 7. A GOOD HORIZONTAL COIL

wall outside the building. Fig. 8 shows the method of constructing.

Special Kinks

In the cases previously described, the manifolds are usually 2 by 1 by 1 in., but except in very large coils, I always bush the inlet to 1 or 1¼ in., as it saves cost both in pipe and valves, loss in radiation where heat is not needed, and pipe covering; for all supply pipe should be covered.

Where appearance is not important I use flanges instead of unions—that is if there is room to use a wrench on the nuts back of the pipe—as they are cheaper and just as reliable.

In connection with unions there is one thing to which I want to call particular attention; some fitters will dope the pipe threads, but never think of the threads on the union joint, and a leak will sometimes occur, due to not taking up tightly or in repairing water will sometimes trickle out of a pipe and wet the threads which, unless they are well doped, will make it difficult to break the union at the proper place, the union often turning bodily on the pipe.

A few rules which I have adopted for my own guidance are these:

Always cover all supply pipes.

Always pitch pipes in direction of flow and towards a bleeder, and use bleeders at all vertical rising pipes.

Use tees and plugs instead of ells if there is any possibility of needing them for additional connections; also in long lines, instead of couplings, tees and plugs will prove a good investment.

Support pipes securely, so that no pockets can form.

Use plenty of good "dope," and rub it in well.

Use good rubber or other gasket material and always graphite or chalk one side of the gasket to prevent sticking to both flanges and spoiling the gasket.

Graphite and oil all flange bolts or nuts.

Keep patterns for all gaskets used; whenever a new

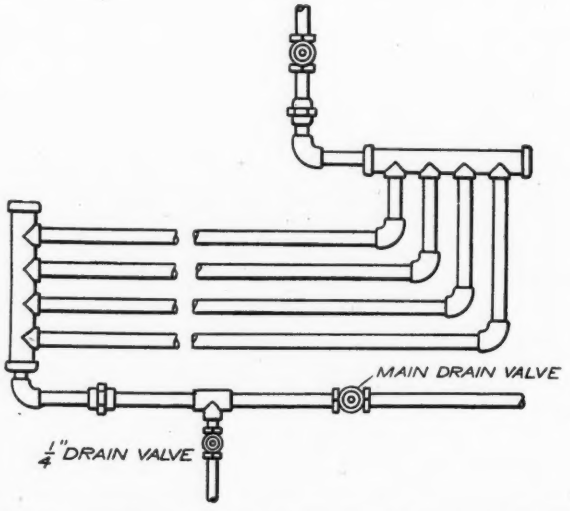


FIG. 8. ARRANGEMENT OF ¼-IN. SUPPLEMENTARY DRAIN VALVE TO DRY OUT A HEATING SYSTEM

shape or size is required take time to make a pattern for it, and many a repair job will be shortened by having gaskets cut in advance, not forgetting to leave an "ear," or odd corner, to assist in placing the gasket, particularly if the flanges are hot.

Use good valves of the renewable disk or regrinding type.

Timely preparation is half the job, particularly if steam can be spared but a short time. By having all tools needed at hand and all gaskets cut in advance much time can be saved.

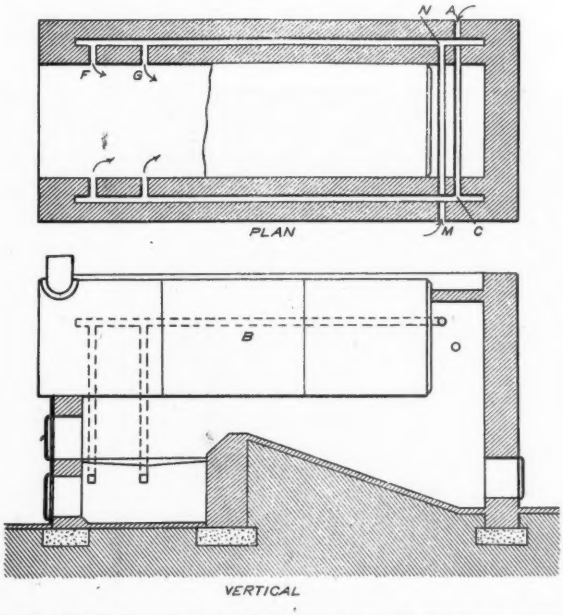
BOILER SETTING

By C. R. McGahey

IN THE plan shown is an arrangement of air ducts for carrying a current of air to the under side of the grates in the furnace. In the first place, in setting a boiler, air passages are formed in the sides of the brick boiler setting by leaving a space when lay-

ing the brick. By using a piece of 3-in. boiler tube or pipe placed in the wall so as to pass through under the back arch, entering at A, as shown on the plan, going through the wall and entering the second wall in the air space, as shown at C, the air duct is formed in the side wall. Several of these pipes are set in as described, say 3 from one side and 3 from the other, connecting with the air passages in the walls as indicated.

Air will enter these tubes, pass through the combustion chamber, becoming heated to the temperature of the combustion chamber, then pass through the side walls and come out under the grates through passages left in the brick work for that purpose. The air entering at A, for instance, passes through to C, then through the air space in the side wall and escapes at the openings X Y.



PLAN AND ELEVATION OF EFFICIENT BOILER SETTING WITH HOT AIR DUCTS

By this arrangement quite a saving in coal is effected, as the boiler can be run with the ashpit doors closed with sufficient draft. I have found that when firing light, 4 3-in.tubes on each side will increase the efficiency of the boiler setting considerably by working with the front doors partly closed.

POWER FOR BUILDING THE LOS ANGELES AQUEDUCT

Probably no greater feat of hydraulic engineering has been attempted in this country than that undertaken, scarcely a year ago, to secure for the city of Los Angeles, Cal., a water supply from the snow-fed Owens River and its tributaries by means of a 215-mile aqueduct, which will bring 400 cu. ft. of pure snow water per second into the city.

In building a work of such magnitude it necessarily followed that the question of adequate and cheap power to use in excavating, to drive the tunnels, and to hoist material up steep mountain sides was of prime importance; but the large expense of power generated by steam at practically all parts of the line seemed to be a serious difficulty to overcome. These considerations early suggested the advisability of using electricity as the motive power.

Eventually, current is to be furnished from hydro-electric plants built along the line of the aqueduct, the output of which can be used wherever needed to drive the construction plant. But the chief source of electrical energy from the first will be from the mains of the Los Angeles Edison Co., whose high-voltage transmission lines extend to the city of Los Angeles from the Kern River Hydro-electric plant, owned and operated by the company. Ample power will thus be obtained for the entire project, and this power can be delivered over transmission lines so readily that any other method of supplying power would be out of the question in cost and convenience.

In many respects the Kern River development is unique. It is claimed to be the largest hydroelectric plant west of Niagara. The transmission line of 117 miles is one of the longest in the world. The pressure of 75,000 volts over such a length of cable is among the highest ever attempted. The conduit which leads to the pressure main is the longest underground tunnel system in use for this purpose. The concrete encased penstock, from which the supply will come, tapering so as to accelerate the force of the water at the power house, is said to be the first of its kind ever placed in service.

The 4 big wheels which convert hydraulic into electric energy, were built by Allis-Chalmers Co., of Milwaukee, and each has a capacity of 10,750 hp. at full nozzle opening, and a speed of 250 r. p. m., when operating under a net effective head of 865 ft. In addition to the main turbines there are 2 exciter turbines, also of Allis-Chalmers design, each with a capacity of 450 hp. and a speed of 430 r. p. m.

The turbine units are of the impulse type. Each unit has 2 runners, 1 on either end of the generator shaft. The interchangeable buckets are made of non-corroding phosphor bronze of special mixture for the high head and are attached to the cast steel disks bolted to the flanged ends of the generator shaft.

The nozzles are provided with hand adjustable needles and arranged to be deflected by the governors automatically, or by the latter's hand-regulating device. By deflecting the jet, instead of regulating its discharge by adjusting the needle with the governor, it is possible to secure a constant velocity of water in the pipe-line, as well as a constant discharge of water into the tailrace, even when the plant is operating with heavy fluctuations of the commercial load.

ONE CUBIC INCH of water weighs 0.036 of a pound.

GAS ENGINES AND PRODUCERS

THE CITY OF SOUTH NORWALK ELECTRIC WORKS

By G. P. Hutchins

SIXTEEN years ago the City of South Norwalk was supplied with electric light and power by a private concern, which disregarded the public demand for better service. All remonstrances proving in vain, after a series of public meetings, the citizens voted an appropriation of $22,500 with which property was purchased and a plant of 100 hp. erected, to supply 86 open arc, series lamps and service was begun on Friday Oct. 13 1892.

Right here let it be pointed out to those whose superstitions cause a shudder at the mere mention of Friday the 13th that it would be hard to find an honest citizen of South Norwalk who will not declare the day to have proved one of the most fortunate in the history of that city. The city fire alarm system was at the same time transferred to the plant—an innovation which has proved singularly advantageous.

Increase of Capacity

After several years of street lighting the results were so encouraging that in Oct. 1897 a further appropriation of $20,000 enabled the city to enlarge its plant and offer current for general commercial purposes. This extended service was inaugurated in August 1898 and a carefully formulated plan developed whereby the income from the sale of current rendered the plant not only self-supporting but furnished money toward the liquidation of the debt of the electric works, and provided the means of still further additions to meet the rapid growth of business and current demand.

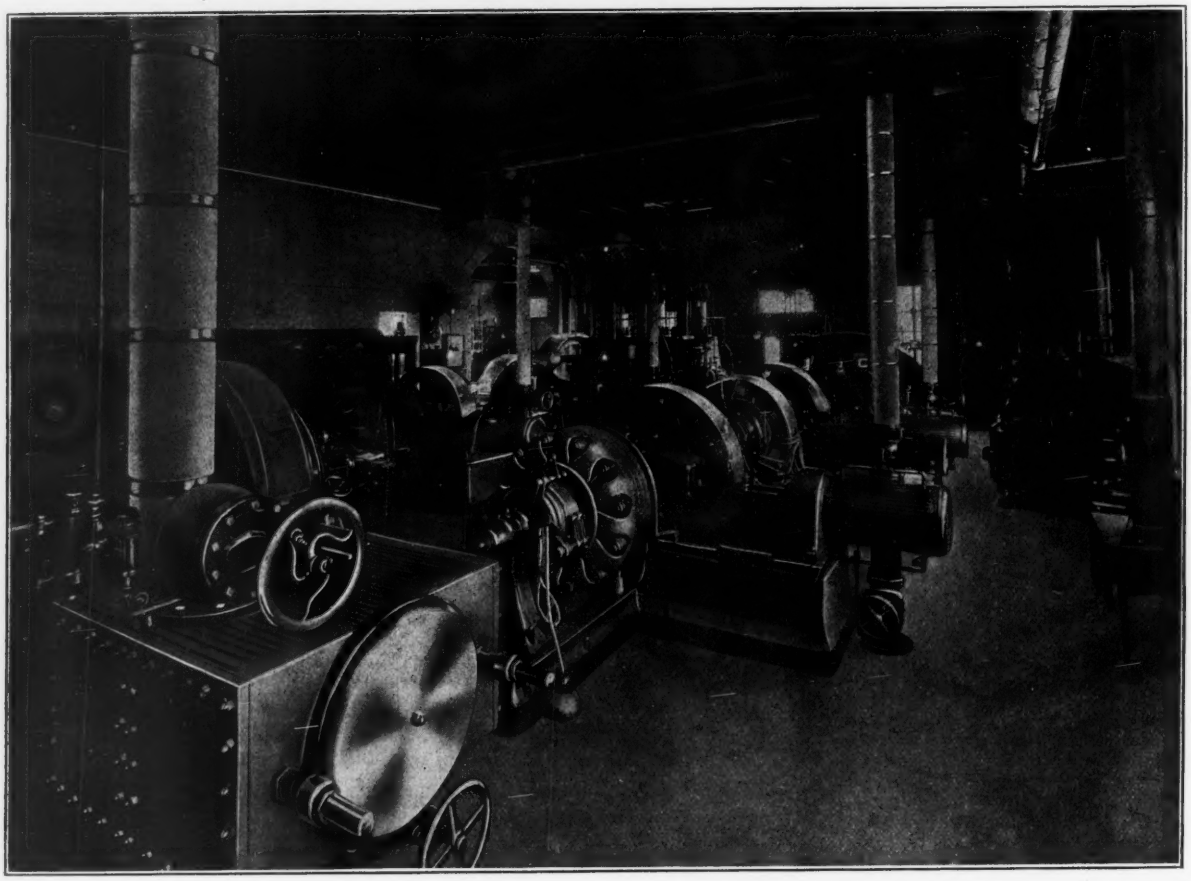


FIG. 1. GENERAL VIEW, SOUTH NORWALK ELECTRIC WORKS

This increase in current demand was so great that

the city records show appropriations for 1900 and 1903 of $17,500 and $20,000 respectively for the purchase of new equipment to replace the old dynamos and engines after their 11-yr. service.

In 1901 the power system of the local company was purchased and service still further extended, but by the end of 1904 the demand again exceeded the supply and the plant business had outgrown its natural limitations.

Installing Oil Engines

An increase in boilers for added steam power would have necessitated the removal of the entire plant to the city water front in order to secure dock facilities for handling coal and ash as well as convenient condensing facilities. In view of the great trouble and expense involved in such a move the alternative of installing the increased motive power in combustion engines was discussed. After an investigation of all types of producer gas, gasoline and oil engines it was decided to install an American Diesel crude oil engine of 250 hp., coupled with a 160-kw. Fort Wayne generator, the town council endorsing the report of the commission.

Just 4 months later the new unit was installed. The crowded condition of the plant is shown in Fig. 1 in which the Diesel engine appears in the background and the older steam equipment in the foreground.

One interesting feature developed at this time was the utilization of excess steam and the securing of an extra load on the boilers by heating the depots and stored cars of the N. Y., N. H. & H. railroad, situated close by the plant. One reads much these days about the profit to be found in the utilization of waste steam in district heating and perhaps the suggestion in the present instance may serve some reader as a valuable hint for the profitable employment of his own waste B. t. u's.

Considering the fragmentary growth of this plant a visitor would expect almost anything except the orderly, though somewhat crowded appearance that meets his eye. The main building is of brick 1.5 stories high, 109 ft. long and 48 ft. wide, with brand new office addition required by the latest changes to be described.

Boiler Plant

In the fireroom are 4 horizontal return tubular boilers rated at 125 hp. each, a feed-water heater, injector and the usual complement of pumps, together with an unusually complete arrangement for weighing all coal.

Engines and Generators

In the engine room are 5 Watertown simple engines, each connected to 25-volt direct-current multipolar generators. Of these latter 2 are 60-kw. Siemens-Halske machines, 2 60-kw. Eddy and 1 165-kw. Fort Wayne. In addition there is the 160-kw. Fort Wayne generator connected to the Diesel oil engine. This last has for almost 2 months been the backbone of the plant, running practically day and night and carrying the greater part of the average load. A Norwalk 2-stage air compressor belted to a 25-hp. General Electric motor is used to compress the air used in starting the Diesel engine and in injecting the crude oil into the cylinder in a fine spray.

The essential principle of the Diesel engine, whereby it is enabled to show its marvelously high thermal efficiency, is the compression of pure air only on the compression stroke, to a pressure of 35 atmospheres, and to inject the oil as a fine spray into this "red hot air." Naturally, preignition, which would occur with any mixture of oil vapor and air long before the compression point of the Diesel cycle were half reached, is impossible and the temperature of the air due to compression alone is sufficient to instantly ignite the fuel as introduced.

Operating Cost

The fuel oil for the Diesel engine is stored in an underground tank outside the building and pumped through a measuring tank to the engine fuel valve. At the present time the city is paying 3.75 cents a gallon for its crude oil, delivered, the fuel cost per kilowatt hour with the Diesel engine being 3.5 mills.

The following data are interesting as showing the economy of the South Norwalk Electric Works:

Average income per kw.-hour	$ 0.04479
Average cost per kw.-hr, including interest, depreciation and operating expenses	$ 0.02764
Average profit per kw. hour	$ 0.01715
Gallons of fuel oil consumed last year	59,163
Pounds coal consumed last year	2,500,810
Average cost of coal per kw. hour	$ 0.02250
Average cost of fuel oil per kw. hour	$ 0.00359
Average pounds coal per kw. hour	8
Average Watt-hours per gal. fuel oil	9916
Average Watt-hours per lb. coal	114

The commission estimates that the cost of street lights last year was $6540, which is $1526 less than they would have cost if paid for at the rate of $74 a lamp per year, the price charged by a private company. At the average price obtaining in Connecticut of $83.71, the total saving on street lighting alone since the establishment of the plant has been $21,478.09.

The new Diesel oil engine unit has been installed in the space hitherto appropriated for the office. A new office addition has been built "big enough," as Mr. Winchester, the superintendent and general manager of the works, told the writer, "to set up another Diesel engine unit in when the time comes."

The new unit is a counterpart of the former engine and generators except that it shows the natural improvement to be looked for in the product of any progressive manufacturer.

It has been said from olden times that "the proof of the pudding was in the eating," but our modern sages have modified the proverb, possibly with our national disease of indigestion in mind, and now have it that "the real proof of the pudding is in the digestion thereof." South Norwalk suffers from no symp-

toms of municipal ownership indigestion, although it has eaten heartily of the fruits thereof.

One cannot study the history of the success of the South Norwalk plant without remarking the skill and devotion of Albert E. Winchester, commissioner of the works, chief of the fire department, manager, chief engineer and brain of the plant. History shows that Mr. Winchester abandoned a professional career of brilliant promise to assume active charge of this modest little plant in his home town, and that he has shown untiring energy and devotion to the cause undertaken during the many years of his management.

Opponents of municipal ownership have said, "It is not municipal ownership which has succeeded; it is Winchester's personal success."

I promised that this would be no essay on government ownership, and I leave the merits of the case to the reader's judgment. To the writer of these lines the plant is a deeply interesting one which loses none of its interest by the possession of a presiding genius.

WHAT HAPPENS IN THE GAS PRODUCER

CHANGE OF COAL TO GAS AND WHAT THE GAS IS MADE OF

By R. T. Strohm

FIRST of all, it is well to keep in mind the fact that the generator does not create the energy that is utilized in the gas engine later on. The elementary substances that enter the furnace are combined in a certain way, and the producer simply breaks up these combinations or compounds and causes them to be rearranged in the desired gaseous form.

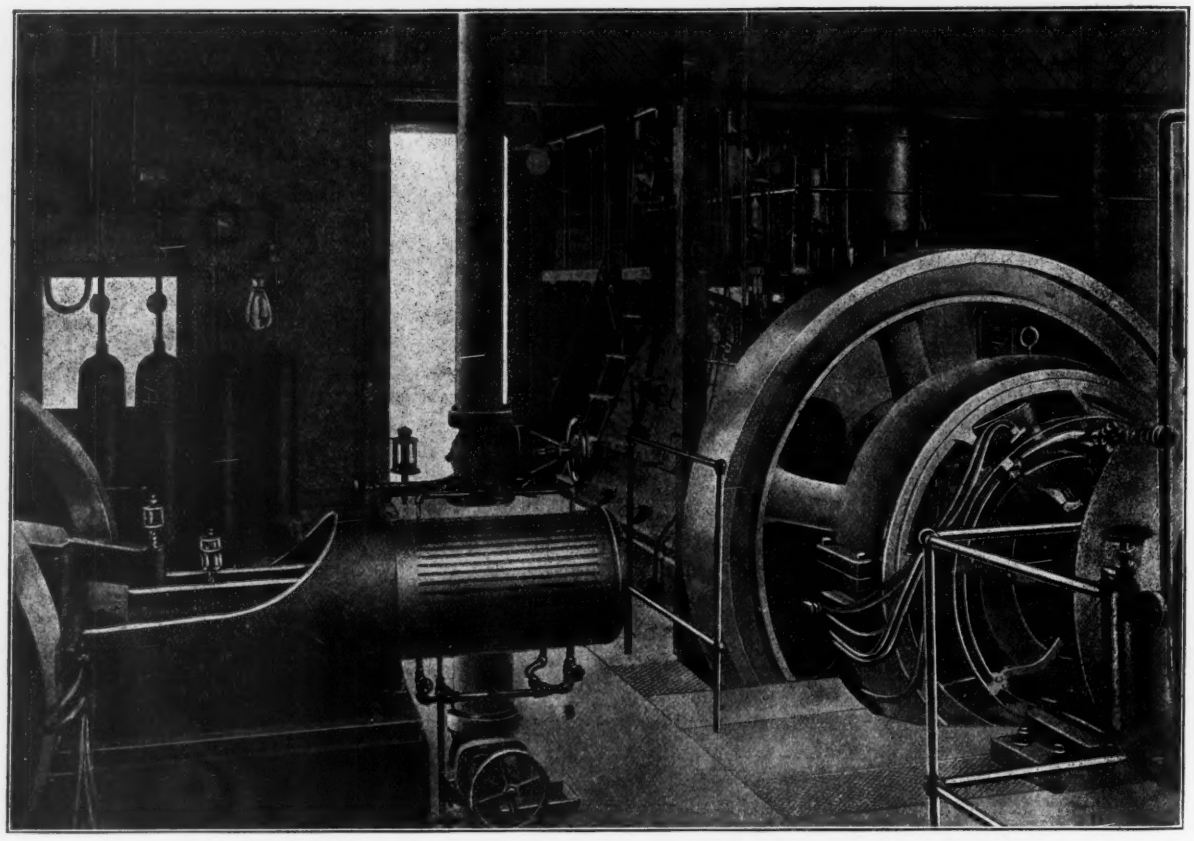


FIG. 2. DIESEL ENGINE UNIT AND BOTTLES FOR COMPRESSED AIR FOR STARTING

Material Supplied

For example, take the case of a producer using anthracite coal as a fuel. The only things that enter the generator to produce the gas are coal, air, and water vapor. If these 3 substances are resolved into their elements, the materials supplied to the combustion chamber will be found to consist of carbon, hydrogen, oxygen and nitrogen, together with a greater or less amount of ash.

The coal is composed of carbon and ash in solid form, and hydrogen and oxygen, the hydrogen being

partly combined with some carbon as a volatile constituent, and the remainder with oxygen as moisture. The air supplied contains oxygen and nitrogen. The water vapor is composed of hydrogen and oxygen.

Now, since the only solids removed from the generator are those composing the ash, it is evident that the solid carbon must be transformed into a gaseous combination, since the products issuing from the upper end of the producer are wholly gaseous, and there is no loss if the apparatus is tight. The nature of this action may be simply explained as follows:

Reactions in the Fuel Bed

A deep, heavy bed of fire is maintained in the bottom of the generator, the heat being derived from the union of the carbon and hydrogen of the coal and the oxygen of the air. The result of this combustion is precisely the same as that which takes place in a steam boiler furnace. Carbon dioxide and steam are formed as the gaseous products of combustion.

But, above the incandescent fuel is a deep layer of coal, through which the hot gases from the combustion zone must rise, and in so doing they bring this coal to incandescence. The supply of a sufficient amount of air to this upper zone would cause the fuel there to burn to carbon dioxide, the same as at the bottom of the generator; but this is not permitted. The gases that rise through the upper layers of coal are the carbon dioxide formed below, the inert nitrogen of the air, and the water vapor, now converted by the heat into highly superheated steam.

Not a single one of these 3 gases is capable of supporting combustion, and as a consequence there is no combustion in the upper zones of the generator. Instead, there is a rearrangement or recombination of elements that results in the formation of producer gas. The carbon dioxide as it passes through the glowing coal is broken up by the heat in the presence of the carbon, and taking up more carbon, becomes carbon monoxide.

The moisture that enters the generator is composed of hydrogen and oxygen. Under the influence of the heat it is dissociated, or split up, into its elements. Passing up through the incandescent coal, the oxygen of the water, in the presence of the incandescent coal, unites with carbon to form carbon monoxide, while the hydrogen is left free and uncombined.

The nitrogen originally contained in the air passes through the generator without change of its nature and appears in the producer gas as free nitrogen.

It must not be understood from the foreging that all of the carbon dioxide is converted into monoxide, for such is not the case. Nor is all of the oxygen united with carbon as monoxide or dioxide. Under actual conditions of operation there usually is a greater or less amount of carbon dioxide and of free oxygen in the resulting gas.

Of course, the chemical composition of the fuel used in the generator will have considerable influence upon the quality and composition of the gas generated; also the conditions of operation, if varied, will result in changes of composition of the gas.

Under any circumstances, producer gas is a lean gas. That is, its heating value per cubic foot is low, since it contains but a small percentage of hydrogen and hydrocarbons. A rich gas, like natural gas, is one in which the hydrocarbon content is large.

Composition of Producer Gas

As an example of what may be expected in the composition of producer gas, the following analyses are given, one for gas made from anthracite and the other for gas derived from bituminous coal. These analyses are volumetric; that is, the various percentages are parts of the total volume of the sample.

Table I. Analysis of Producer Gas

	Per Cent	
Constituents of Producer Gas	Anthracite	Bituminous
Carbon monoxide, CO.....	27.0	27.0
Carbon dioxide, CO_2.....	2.5	2.0
Hydrogen, H.....	12.0	12.0
Marsh gas, CH_4.....	1.2	2.5
Nitrogen, N.....	57.3	56.5
	100.0	100.0

As was to have been expected, the gas from bituminous coal shows a greater percentage of marsh gas than that from anthracite, due to the higher content of volatile hydrocarbons in the former. The inert gas nitrogen forms more than 50 per cent of the volume of the resultant gas, and as it has no heating value the total heat realizable from producer gas is low. The heat value will vary somewhat, according to the composition of the gas, but it usually ranges from 110 to 160 B. t. u. a cubic foot.

Of course, all producer gas will not conform to the analysis just quoted. There are bound to be wide variations in the composition of the gas, due to such causes as the nature of the fuel used, the temperature of the fire, the care displayed in tending the fire, the variation in amount of steam used, leakage of air, and methods of feeding the fuel to the generator. These several factors and their influences will be further discussed in detail.

To illustrate the difference in the quality of gas as produced by different fuels, the following analyses of gases formed from lignite and from peat are given:

Table II. Gas Formed from Lignite and Peat

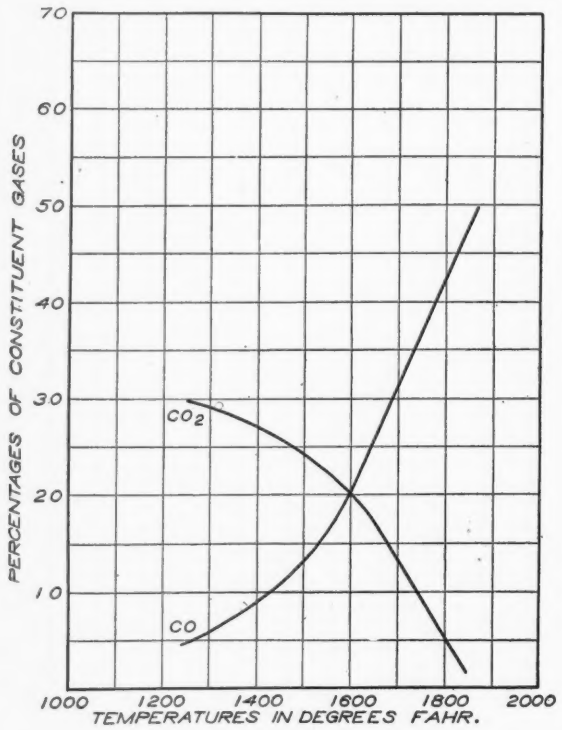
	Per Cent	
Constituents of Producer Gas	Lignite	Peat
Carbon monoxide, CO.....	23.2	22.5
Carbon dioxide, CO_2.....	9.0	10.5
Hydrogen, H.....	15.5	13.9
Marsh gas, CH_4.....	2.7	2.1
Nitrogen, N.....	49.6	51.0
	100.0	100.0

Comparison of these analysis with each other and with the two preceding analysis will show distinct changes in the proportions of the component gases.

Effect of Temperature

Variation in the temperature conditions in the generator will likewise cause the composition of the resultant producer gas to be altered. The results of a number of tests in which various temperatures were maintained show that a low temperature is conducive to the formation of a large percentage of carbon dioxide and a correspondingly small amount of carbon monoxide. With increased temperatures however, the amount of dioxide rapidly decreases, while the amount of monoxide is increased.

The percentage of free hydrogen is slightly lessened as the temperature decreases. This may be explained on the ground that a low temperature in the generator serves merely to drive off the volatile hydrocarbons from the fuel by a distillation process,



RELATION OF TEMPERATURE IN PRODUCER TO GASES FORMED

whereas the higher temperature causes dissociation of these volatile compounds, together with the utilization of a smaller amount of steam; and as the latter is responsible for a large part of the hydrogen in the resulting gas, the percentage of this element is somewhat lessened. The curves show in a graphic way the effect of increased temperatures upon the percentages of carbon monoxide and carbon dioxide in the power gas produced.

Use of Steam

Reference has already been made to the use of steam or water vapor, which is admitted into the ashpit with the air supply and is drawn up through the fire in the generator. This steam serves several purposes. The main reason for using it is to enrich the gas by the hydrogen set free when the steam is decomposed.

On passing through that part of the fuel bed where combustion is occuring, the steam first becomes superheated, and then, finally, under the influence of the high temperature, becomes dissociated into the elements hydrogen and oxygen. The oxygen thus liberated is free to combine with the carbon of the fuel, forming monoxide and dioxide, while the hydrogen remains uncombined, appearing as free hydrogen in the producer gas.

Thus, the supply of oxygen necessary to support combustion and to form the desired percentage of carbon monoxide is derived from two sources. First, from the air supplied to the generator; and second, from the steam admitted with the air. By far the larger proportion of the oxygen, of course, comes from the air supply. Of the carbon burned, about 4/5 derives its oxygen from the air, while the remaining 1/5 receives oxygen from the decomposed steam. Since air is composed of 21 per cent of oxygen and 79 per cent of nitrogen, by volume, it is evident that by deriving some of the oxygen from the decomposed steam, the percentage of inert nitrogen in the gas will be reduced, which is, therefore, another advantage of the use of steam, since the nitrogen has absolutely no value as a heating agent.

On account of the high heating value of hydrogen, increasing the amount of steam used will result in gas of increased heating value; however, the amount of steam cannot be increased indefinitely. If used in excess it will pass through the fire without being decomposed, and will reappear in the gas as steam, its effect then being to lower the heat value of the gas. The reason for this action is that the decomposition of the steam exerts a cooling effect upon the fire.

In order to break up the steam or vapor into its elements, hydrogen and oxygen, as much heat is required as would be generated by the recombination of those elements. The perfect combustion of 1 lb. of hydrogen requires 8 lb. oxygen, resulting in 9 lb. of water, and the heat developed by this action is 62,000 B. t. u.; hence, for every pound of hydrogen set free from water, 62,000 heat units must be absorbed from the fire. However, the 8 lb. of oxygen liberated from the water will unite with 6 lb. of carbon to form carbon monoxide.

As the burning of 1 lb. of carbon to monoxide generates 4,400 heat units, the burning of 6 pounds would produce $6 \times 4{,}400 = 26{,}400$ heat units. The entire action then reduces to the following: To set free 1 lb. of hydrogen, 62,000 heat units are abstracted from the fire, while the combustion of carbon with the resulting free oxygen generates 26,400 heat units, leaving a net loss of $62{,}000 - 26{,}400 = 35{,}600$ heat units for every pound of hydrogen liberated. Understanding this clearly, it is easy to see that if too large an amount

of steam is introduced, the heat abstracted from the fire will be so great as to reduce the temperature of the fire to such a degree that it will no longer decompose the steam, and the latter will simply pass through the generator unchanged.

Gain from Steam

Up to a certain point this cooling effect of the steam is advantageous. If a blast of air only was supplied, the temperature of the fire would become so great as to cause serious difficulties in the operation of the producer. Conditions would then approach those found in steam boiler practice.

The temperature of the fire would be perhaps 2500 deg. F. or higher, with the result that the fusible material in the ash would be acted upon by the heat, and clinkers would be formed. This would be followed by the formation of channels in the fire bed through which the air could pass directly to the gas outlet without change of condition, resulting in a lessening of the calorific value of the producer gas and greater difficulties in management of the fire.

By the use of steam with the air, the formation of clinkers is prevented, as the fusible impurities are kept porous by the steam, preventing the formation of large air channels. In the absence of clinkers, the ash may be shaken down without difficulty and the bed of the fire can be kept uniform in condition.

When the gas is to be used in gas engines it is sent through a scrubber after leaving the generator. Hence, the heat carried away by the gas will be given up to the water in the scrubber and thus be wasted. By the use of a steam blast, with its cooling effect, the temperature of the gas leaving the generator is much reduced, and the heat loss is made correspondingly less. Under normal working conditions, the temperature of the fire should be about 2000 deg. F. at the hottest part.

Effect of leakage

Another consideration that will affect the quality of the gas produced is the tightness of the generator shell. If there are any leaks through which air may enter, a portion of the gas will be burned to carbon dioxide which is incombustible and therefore reduces the value of the producer gas.

The method of feeding fuel to the generator, and the care exercised in doing so, will also have some influence on the quality of the gas. The sudden addition of a large amount of fresh fuel may so reduce the temperature of the upper part of the fire bed as to prevent the decomposition of the carbon dioxide ascending from the fire beneath, and thus the percentage of dioxide in the gas would be increased.

POWER PLANT PRACTISE

In a paper before the Illinois Society of Engineers, Prof. J. C. Thorpe, of the University of Illinois, gave the following interesting figures:

Tests of double-stoker, 500-h. p. boilers have shown an increase of 80 per cent in the capacity of the boilers with practically no loss in efficiency, which leads to the prediction that we are approaching the time when we shall be able to rate water-tube boilers at 5 sq. ft. of heating surface per horsepower instead of 10 sq. ft.

Fuel Cost

In the matter of fuel costs there is great variation, running from 25 to 70 per cent of the total operating expense. In one 2000-kw. station in Illinois, the cost of coal was $0.75 a short ton and the fuel cost per kw. hr. was 0.219 cents, the total cost of operation being 0.443 cents and fixed charges 0.057 cents, so that the fuel cost was 43 per cent of the total expense.

Professor Fernald gave as the cost on a 4000-hp. down-draft producer equipment 0.64 cents a kw. hr. total of which 0.209 cents, or 32.7 per cent, was for fuel. In a plant using oil fuel with steam at 150 lb. pressure and cross-compound, condensing direct-connected engines, oil at $0.50 a barrel, the fuel cost was 0.309 cents a kw. hr. or 36 per cent of the total cost, which was 0.859 cents.

Cost of Supplies

Under this head are included oil, waste and miscellaneous articles, which vary widely in price and in amounts used. In well managed plants the following may be taken as the average values for the supply cost.

100 to 250 kw. plant, 0.04 cents per kw. hr.
250 to 500 kw. plant, 0.03 cents per kw. hr.
500 to 1000 kw. plant, 0.02 cents per kw. hr.
1000 to 5000 kw. plant, 0.017 cents per kw. hr.
5000 to 10,000 kw. plant, 0.015 cents per kw. hr.
10,000 to 20,000 kw. plant, 0.013 cents per kw. hr.

In the 2000-kw. station previously mentioned, the "oil and supplies" charge was 2.5 per cent of the total expense, which did not include fixed charges, and in the 4000-hp. plant "oil and waste" cost 5.5 per cent of the total expense. Cost of lubrication as between turbines and gas engines is as 35 to 177 and the 2000-kw. station was turbine driven with reciprocating engines to help out at peak load.

Labor Costs

These vary widely, depending on the type of machinery, size of units, and arrangement of schedules; the variation is often 50 per cent. Load factor has an important effect as seen in the table following:

Load factor 25 per cent, cost per kw hr. labor 0.00172 cents.

Load factor 33 1/3 per cent, cost per kw. hr. labor 0.00128 cents.

Load factor 50 per cent, cost per kw. hr. labor 0.00086 cents.

Load factor 75 per cent, cost per kw. hr. labor 0.00057 cents.

Load factor 100 per cent, cost per kw. hr. labor 0.00043 cents.

It is evident that the cost increases very rapidly as the load factor falls below 50 per cent.

ELECTRICAL MACHINERY AND APPARATUS

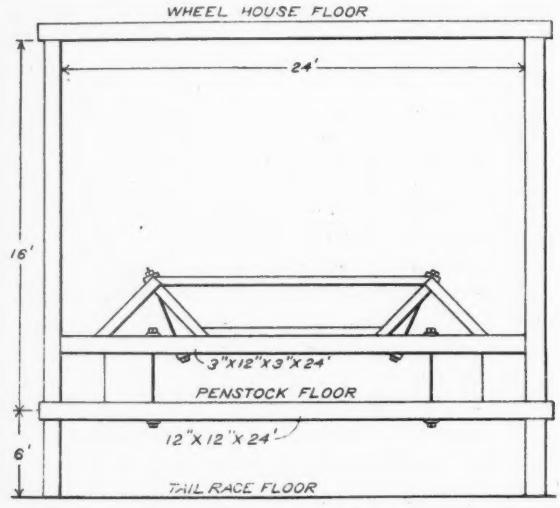
WITH A COUNTRY WATER POWER

By D. B. Little

RUNNING a small hydroelectric plant, may be thought by many, to be of small importance; but to the man in charge, it is of the utmost importance for him, to produce the goods, and this is just where it makes him get into a dark brown study at times.

To illustrate, in the place where we work, they have 2 waterpower privileges, 1 of which was acquired about 4 years ago, the penstock of this is located about 280 ft. from the head gates, and connected by 3 tunnels, each 6 ft. square by 270 ft. long. The penstock is 24 by 60 ft. and 16 ft. deep from floor to floor, with a tailrace under the entire penstock 6 ft. deep.

When purchased there were 4 60-in., 1 40-in., 1 36-in., old American waterwheels and 1 48-in. new American wheel of improved pattern, and in good order, the 60-in. wheels were in bad condition, and it



TRUSSING FOR PENSTOCK FLOOR

was decided to pull them out, along with the 40-in. wheel, and install a 56-in. Leffel Samson turbine. Now you wonder what would cause trouble.

A Limber Penstock

It occurred in this way. The penstock was built 40 years ago, out of oak timbers, framed, and planked, outside and inside, the beam timbers being 24 ft. span supported at the center with posts. All the posts both side and center, below the low water mark, are in fine condition also above high water mark, are in good shape, but where the timber is alternately wet and dry, they rot fast.

Another thing to cause trouble and lots of it, is the fact that the water in passing through the wheels, carries a large amount of air which is trapped, in between the penstock floor and the beams underneath, causing the underpinning to rot, so that when they raised the head water 3.5 ft. by increased height of the dam, the penstock floor settled about 0.75 in. at the center crosswise, with the increased head; as the water was drawn down, the floor would rise again. With the old outfit that was not noticeable, as the old wheels were equipped with jaw clutch couplings on the vertical shaft; but with the Leffel and its bolted flanged couplings, it became evident that something must be done, as this wheel drives a 125-kw. 3 phase alternating current generator, and through this and 8 induction motors, the major portion of the mills. In this case the remedy was the building of 2 trusses out of 2 by 10 by 12-in. plank, spiked and bolted together in the shape shown and putting 1 each side of the Leffel, with the result of only $.25 in. movement and no trouble to speak of. This gives us a running chance to keep the wheels turning, that being the goods above mentioned.

Each truss being built in two sections with 2½-in. queen bolts, No. 1 and 2 and 2½-in. load carrying bolts No. 3 and 4 between the two sections with equalizing bars across to carry the load.

Low Speed Wheel

In making his calculations relative to speed in designing the harness of 2 waterwheels and jackshaft, the consulting engineer who was called in by the owners of a large factory building heavy iron work was given 8 ft. head as a basis, to figure from, which was the average instead of the low head that should have been used. This resulted in too low a speed at low water due to lack of head, and too low a speed at high water, because of too much backwater.

By harnessing the 48-in. New American above mentioned with manila rope to an extension shaft coupled to the jackshaft with a friction clutch,—this being done by home talent, and not very expensive, and so of course not to be advertised, we kept the wheels turning, and as you will notice that's what we are here for.

A Tricky Induction Motor

Another experience was with a 50-hp. induction motor. In starting up this motor, our standard voltage being 220, we had to push the voltage up to 260, and

at that it took from 500 to 600 amperes to move it. At times it seemed to find a sort of subsynchronism and we had to help it along with the aid of an old rope transmission which had been left in place, to use in case of an emergency. And let me mention in your ear, that it was usually some time before the air around that motor was fit to breathe, it was so very sulphurous; if Satan was around he probably went down below and poked up his fires in anticipation; however, we are still here.

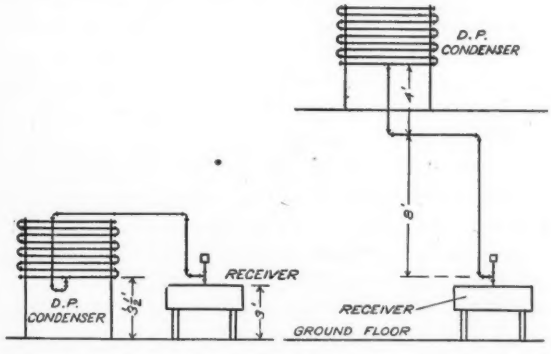
We called in an expert from the makers who made a few tests, stood around and looked wise awhile, then counted the number of bars on the rotor, took the shop marks on the motor, packed his instruments and faded away. In due time a new rotor was unloaded and put in place and the old one sent back to the shop. The motor now gets busy right off and requires only 250 amperes per terminal instead of 600; thus giving decided relief at the switchboard.

A Stuck Bearing

One other motor trouble was the case of a 35-hp. induction motor, which ran dry in the bearing next to the pulley, and stuck fast, about 11 o'clock at night. This caused us to turn out for the rest of the night, because we had to pull off the pulley, then pull off the housing, also pull the shell out from the housing; all this with bolts of various lengths and sizes. Then we found that the babbitt was in very good shape in half the box; so we sawed through the babbitt on both sides of the box to cut out the poor half, then poured new babbitt in that side, and after scraping to a running fit, got the stuff together again. We had her running by 7:15 o'clock next morning being only 25 minutes late, which was satisfactory.

LOCATION OF DOUBLE PIPE AMMONIA CONDENSER

In order to obtain the best results with the least volume of cooling water, the condenser should be so



SKETCH SHOWING PROPOSED PIPING OF DOUBLE TUBE CONDENSER

located as to receive the benefits of all air currents, and at the same time be protected from the rays of the sun. The double pipe condenser has advantages over the atmospheric condenser by reason of being free of the unavoidable splashing which occurs in all atmospheric condensers. It is, however, essential that the cooling water be clear in order to avoid the labor of frequently cleaning the pipes, and the condenser should be so constructed that the ends of the inner, or water pipe, can be exposed for inspection or cleaning without disturbing any of the ammonia joints. These pipes should not be less than 1¼ in. in any case; 1½ in. is better, as the larger pipe is easier cleaned, less friction, less fittings, and consequently less joints to the square foot of cooling surface than is required for 1¼ in. pipe. There is also less liability of having leaks with 1½ in. pipe, because it is lap weld, while 1¼ in. is butt welded. W. S. L.

EXAMINATION QUESTIONS

The following questions were asked in an examination of candidates for hoisting engineers, and are worth while the study of our readers, as they apply to the care of machinery in all kinds of power plants. The best set of answers to these questions will be published in the December issue. Answers will be received up to November 10.

1. How would you prepare a boiler for cleaning?
2. A boiler is to give 120 hp., is to be 16 ft. long and 6 ft. in diameter. What kind of boiler will you use, cylinder, flue or tubular? Give the number and size of tubes or flues, number of feet of heating surface, square feet of grate surface, the kind and size of safety valves.
3. We wish to put in a pair of compound engines in a mine and are to have steam pressure of 150 lb. per square inch, high-pressure cylinder 20 by 28 in. What should be the size of the low-pressure cylinder?
4. We are using 12,000 lb. of coal for a hoisting pump, putting water into the boiler at 45 deg. F. How much coal would be used if water were put in at 100 deg. F.
5. A cylinder boiler is to stand 140 lb. pressure per square inch. What thickness of steel must be used? The boiler is 48 in. diameter; tensile strength 60,000 lb. a square inch; factor of safety 6.
6. A cylinder boiler is 4 ft. in diameter, 18 ft. long, made out of steel 1,038 in. thick. What is its weight?
7. A circular tank filled with water is 12 ft. diameter at the top, 15 ft. at the bottom, 15 ft. deep. The water is at 100 deg. F. How much coal of 13,500 B. t. u. per pound will it take to evaporate the water into steam?
8. With water at 40 deg. F., would you use a feed pump or an injector? Why?
9. What is the breaking strain of ⅞-in. steel wire rope?
10. A lodge in a mine is 26 ft. long, 8.5 ft. wide and 7.5 ft. deep. If it is full of water, how long will it take a 4-in. pump with piston velocity of 100 ft. a minute to empty the lodge?

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COURTESY TO ADVERTISERS

Nowadays a whole lot of good engineering information can be had by reading the catalogs of manufacturers of machinery; in fact, it is often the case that the most up-to-date scientific information is put out in printed form more quickly in catalogs than in books. It goes without saying that the modern illustrated catalog, with its fine halftones and expensive paper, is a costly piece of printed matter, and may run up to a considerable expense in its preparation. Advertising brings inquiries from those interested in the apparatus advertised and in nearly all cases the manufacturer sends, and gladly, catalogs in response to requests.

These requests may come from people who are interested as a matter of curiosity, or from those who simply want the book because it is expensive. They may come also from those who want information about that particular kind of machinery for their future use, or they may come from those who are thinking of buying. Unless the catalogs are very expensive the manufacturer will, as a rule, gladly send copies in response to all 3 classes of requests, but unless he has some means of knowing to which class an inquirer belongs, he is likely to be put to a great deal of inconvenience.

Usually with the catalog, or soon after, goes a letter asking what may be the needs of the person who has written, and asking data on which to supply a price or further information, if desired. The natural course of the manufacturer is to follow up this letter with a personal call of a salesman unless he hears that it is unnecessary. As a matter of courtesy to the advertiser, and simply as an expression of gratitude for his kindness in furnishing the requested catalog, is it too much to expect that the recipient shall acknowlege the receipt and reply to the accompanying letter, so that the manufacturer may know whether the visit of a salesman to supply further information and to submit an estimate will be of any use or not.

The salesman's time and traveling expenses ought not to be wasted in calling on inquirers who simply wish for a catalog and the information that it contains, and the manufacturer, because of his good nature and the willingness to furnish this catalog and information on request, ought not to be put to further expense and trouble. If the one who writes for the catalog acknowledges it, stating that he has received it, is finding it useful and will be glad to keep it for reference when he needs such apparatus, that is all that can be required, will leave no misunderstanding on the part of the advertiser, and will put the reader in the way of being remembered and shown every possible courtesy by the advertiser when the time may come that he wishes to purchase apparatus.

REMEMBER THAT A SLIGHT LEAK from a bad joint in a boiler may cause a severe local grooving.

EDITORIAL CHAT

Gas Engine Horsepower

When you're figuring the horsepower of a gas engine, don't count the revolutions, and think that is all of it. Mostly, gas engines are run on the 4-stroke cycle, so that there's only one working stroke in 4; and with hit-or-miss governing there may be only one working stroke in 8 or 12, if the engine has a light load.

So to get the horsepower you have to count the explosions a minute, and multiply this by the m. e. p., the length of stroke and the piston area, and divide by 33,000.

The Old Open Arc Light

O what has become of the old open arc light,—
The old open arc light that hung on the pole?

It is mostly in the scrap heap; but why? Well, it had too big an appetite for carbon. Firstly, it kept the fireman shoveling coal under the boiler twice as fast as the newer kind of lamp. Secondly, it kept the trimmer putting new carbons in every day. It actually ate up 1 to 1.5 in. of carbon an hour; and the enclosed arc is happy with only 0.08 to 0.5 in. an hour to chew on.

Then the enclosed lamp gives a softer light, not so hard on artificial complexions and on tired eyes, and it's steadier, better broken to harness. The arc inside the inner globe doesn't get blown about so much, doesn't burn up the carbon, and doesn't glare at you as does the bold and brazen open arc. And with the arc closely shut in, the fire danger is small.

For all these reasons, the enclosed lamp saves 10 to 15 dollars a year for its owner over the open arc. No wonder that the old open arc has gone to its rest.

A MODERN POWER STATION

RECIPROCATING ENGINES, HIGH VOLTAGE GENERATORS AND OIL FIRED BOILERS

ONE of the most striking examples of recent large steam power plant design is the plant of the Pacific Light & Power Co., operating at Redondo, Cal., in which were adopted, as prime movers, one of the most modern types of reciprocating engines instead of steam turbines.

Contract

As customary guarantees for water consumption of prime movers, efficiencies of boilers and various auxiliaries, under ideal conditions, were considered of no protection under commercial conditions of variable load, a definite complete plant economy was guaranteed, based on commercial railway load, subject to penalty and bonus stipulations.

A further feature of interest was the provision of the contract that the plant be started and operated by the contractor for a period of at least 3 months previous to the economy test, also during that test, thus thoroughly organizing the operating crew and perfecting the adjustment of the apparatus.

The test to determine the economy of the plant was to have been of 90 days' duration on 1 unit operating on commercial railway load. Inasmuch as the plant had been operating regularly over 6 months previous to test, it was considered that the endurance run was an unnecessary feature of test, and the test period was therefore reduced from 90 to 15 days.

The contract for this station was placed with Chas. C. Moore & Co., engineers, of San Francisco, Cal., the plant having a nominal capacity of 15,000 kw., made up of 3 units of 5,000 kw. each; the contract covered the entire plant installation, including machinery foundations, excepting only switchboard, building, circulating water pipe line, wharf and any other work outside of the building.

General Plan

In order to obtain an ample supply of water for condensing purposes, the plant was located at Redondo, a beach town 18 miles southwest of Los Angeles. Eighteen thousand volts were determined as ample for this distance of transmission, the alternators being wound for this potential without the use of step-up transformers.

The 3 main generators manufactured by the General Electric Co. are of particular interest. These generators are rated at 5000 kw. at 100 r. p. m., 18,000 volts, 50 cycles, 3-phase, and are of the engine driven, flywheel type.

The Pacific Light & Power Co. is engaged in both lighting and power business, although the greater part of the current from this station is used for operating the railways of Los Angeles and suburban towns.

Arrangement of Station

As will be noted from the accompanying drawings, the panel system of design was followed. Owing to the fact that each main engine consists in reality of 2 compound engines connected to the 1 shaft, each having an independent steam and exhaust connection, a further subdivision has been possible with each unit in the connection of ½ the panel of boilers to each high-pressure cylinder, and the provision of a separate condenser and air pump for each low-pressure cylinder, giving in effect the freedom from breakdown corresponding to 6 instead of 3 plant units.

All auxiliaries excepting air pumps are steam driven, the air pumps for each unit being motor driven, by current furnished from the main generator, thus insuring gradual starting of both air pumps in synchronism with the main engine.

The adoption of a siphon system of suction and

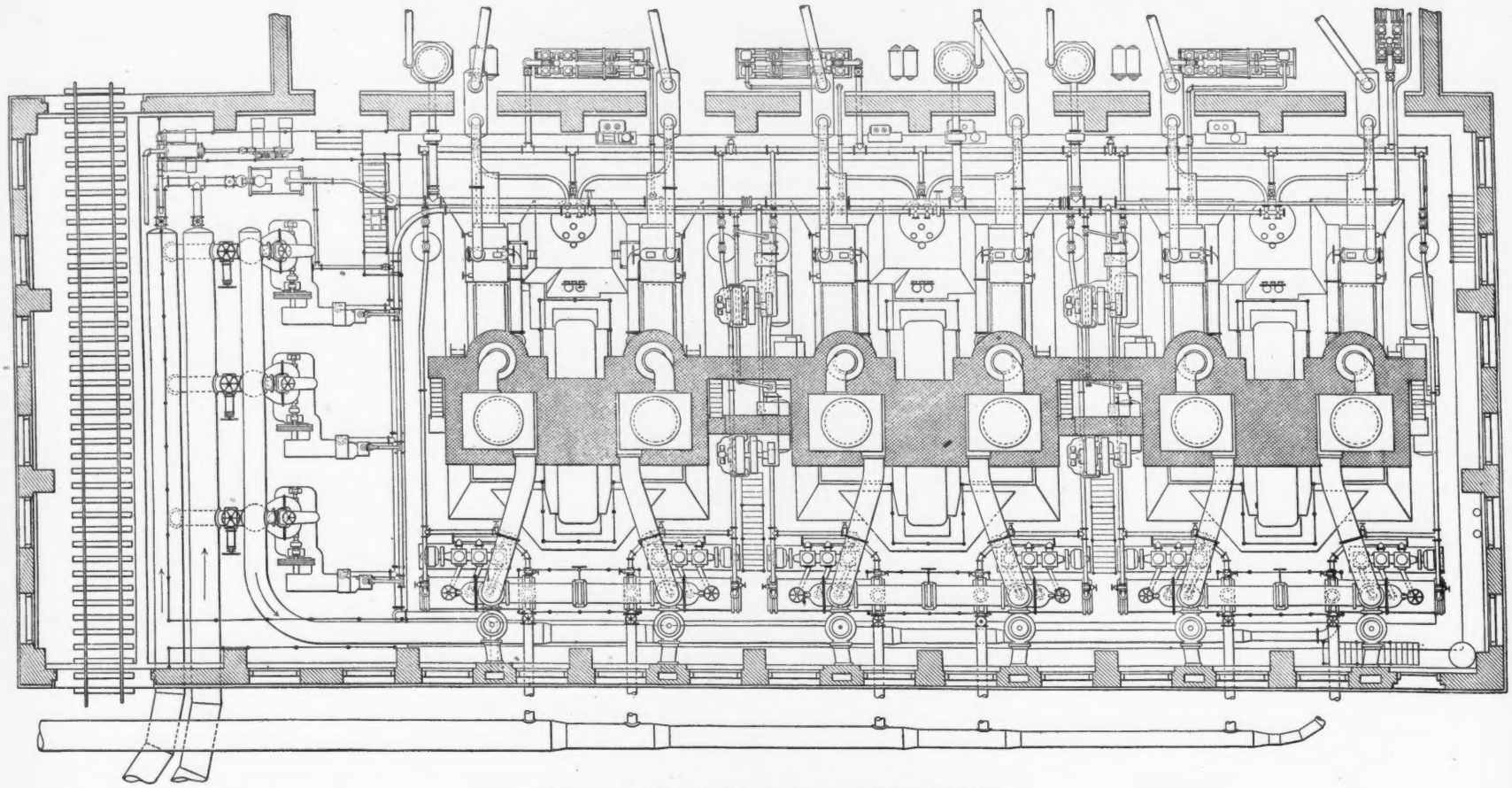


FIG. I. PLAN OF ENGINE ROOM, REDONDO STATION

discharge pipes for circulating water, is due to the location of the plant, the use of a conduit system being impossible. There are 2 50-in. suction mains and 1 discharge line of the same size, supported on a pile wharf carried out to deep water at low tide.

As ocean surf is impregated with air which must be removed from the suction line under vacuum, and further, in order to prime the suction line before starting, after periods of cleaning, a large duplex motor driven vacuum pump was installed. This vacuum pump removes the air by means of a stand pipe rising 40 ft. above tide, located at the high point of the line. There is 1 circulating pump for each unit, with separate connections to both suction lines. All pumps discharge into a common supply main, having inlet connections to all condensers. All condenser outlets are connected to the 1 return main. The flexibility of this system of condensers is at once apparent. Any pump may be used to supply any set of condensers; the engines are speeded up or down, and the number of engines in service is increased or decreased as load conditions require.

The provision of 2 condensers on each unit with cross connected exhaust, is a marked feature of this installation. Should it become necessary for 1 con-

denser to be cut out of service, the exhaust steam from both low-pressure cylinders may be led to the remaining condenser, making operation noncondensing unnecessary, except for a failure of circulating water or the breakdown of both condensers at once. In regular operation with ample water at 70 deg. F. vacuum from 28 to 28.5 in. is easily maintained.

Each air pump discharges into a vertical stand pipe to eliminate entrapped air, after which the water, subsequently used as boiler feed, is passed through a Volz heater in the upper portion of condenser shell, then through a feed water filter, after which it enters the suction main and is pumped into boilers, passing through auxiliary heaters enroute. Entrained oil in exhaust from auxiliaries is so completely removed by

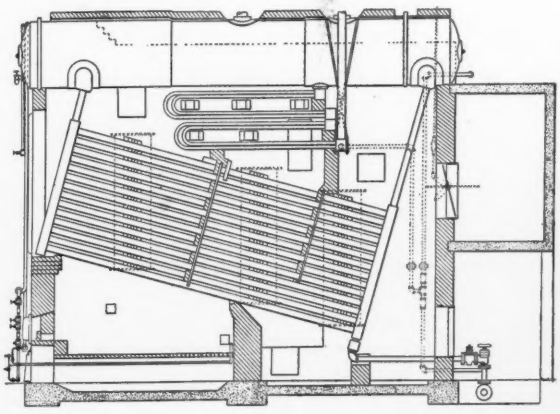


FIG. 3. SECTION OF BABCOCK AND WILCOX BOILER SETTING

means of Cochrane exhaust oil separators that this condensed steam, drained from the body of closed Goubert heaters is as clear as drinking water, and is used for feed purposes.

Each boiler is fitted with superheaters, designed for approximately 100 deg. F. superheat at the boiler nozzles, giving from 80 to 90 deg. at the main engine throttles. Working pressure of 175 lb. is maintained at the engine throttles, all auxiliary engines operating on the same steam pressure and superheat at the main engines with no difficulty.

There are 6 Babcock & Wilcox boilers in the panel corresponding to each main engine, 5 boilers being operated on normal load, the sixth being for reserve.

A novel feature of the boiler plant is the use of secondary tight fitting sliding dampers, which are completely closed during standby periods, to cut down fuel loss due to circulation of cold air through boiler settings.

Each boiler is fitted with Peabody oil furnaces, 3 burners firing forward from the bridge wall and controlled from the front, as shown on the drawing. Fuel oil is supplied to the burners by steam driven pumps. Flame is distributed over a large area of boiler and brickwork surface, minimizing the possibility of burning.

For each panel there is one large Snow outside center packed feed pump, having compound steam end, operated noncondensing and exhausting to the feed-water heater; a fourth pump answers as reserve for the entire plant.

A superheating receiver is placed between each set of high and low-pressure cylinders, superheated steam being supplied to the heating coils at boiler pressure. The condensation from these coils is almost as hot as the water within the boilers, and the proper disposition of this hot water materially affects the economy of the plant; hence, each unit is provided with a Snow receiver pump, enabling the return of this hot feed direct to boilers.

Boilers

Eighteen Babcock & Wilcox water-tube boilers of forged steel construction are arranged in 9 batteries of 2 each. Each boiler, designed for 200 lb. working steam pressure, consists of 21 sections, each having 14 4-in. tubes 18 ft. long, over which are mounted 3

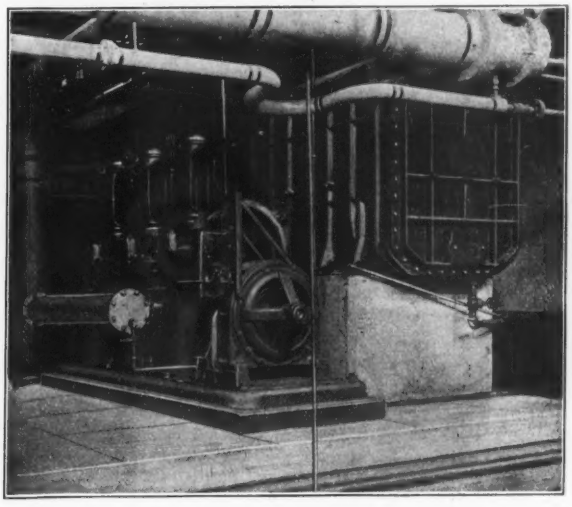


FIG. 5. EDWARDS AIR PUMPS IN BASEMENT

steam and water drums 42 in. diameter. The total effective water heating surface per boiler is 6042 sq. ft.

Engines

The plant includes 3 34 and 70 by 56-in. combined double horizontal and vertical, compound, side crank, McIntosh & Seymour engines. Each engine has 2 horizontal high-pressure cylinders and 2 vertical low-pressure cylinders.

Engines are fitted with metallic packing on all piston rods and on all valve rods The packings on low-pressure cylinders are designed to minimize the leakage of air into those cylinders which tends to destroy vacuum in the condensers.

Situated beside each main engine is a 75-kw. General Electric exciter, direct connected to a 9 and 17 by 12-in. Harrisburg tandem-compound noncondensing piston valve engine.

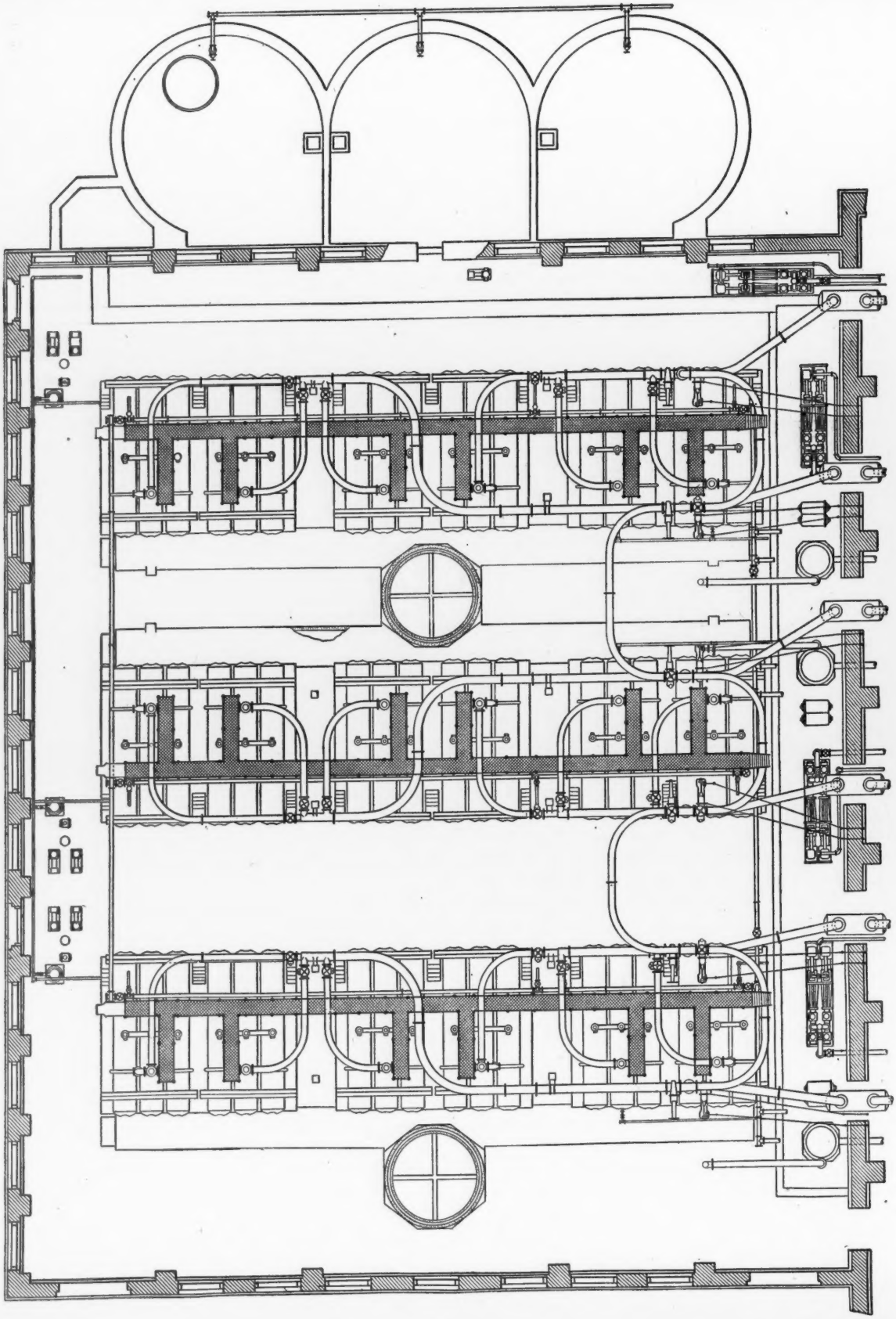


FIG. 2. PLAN OF REDONDO STATION BOILER ROOM

Condensers

The plant contains 6 Wheeler "Admiralty" surface condensers, 1 being for direct connection to each low-pressure cylinder of each main engine. Each condenser contains 5200 sq. ft. of cooling surface. The tubes are brass, ¾ in. outside diameter, No. 18 gauge. In addition to the regular cooling surface of each condenser, there is provided in the upper compartment a series of tubes comprising what is termed the Volz heater. After being discharged from the air pump the condensed water passes through this heater under atmospheric pressure and is heated to within a few degrees of the temperature of the exhaust steam surrounding the heater tubes. The makeup water is also brought in at this point, securing the benefit of heat which would otherwise be wasted.

Air Pumps

With each condenser is furnished an Edwards vertical triplex air pump, having 3 cylinders 16-in. in diameter, 10-in. stroke, single acting. This air pump is of the suction valveless type, all suction valves being dispensed with. The condensed steam and noncondensible vapors flow continuously by gravity from the condenser to the base of the pump and are removed by a conical bucket or piston, which works in a base of similar shape. Each pump is driven by a 25-hp.General Electric induction motor, mounted on an extended base and connected to the pump by a rawhide pinion.

Circulating Water Pumps

Three engine-driven centrifugal circulating pumps are furnished, each having 20-in. diameter discharge and 2 15-in. suctions. Centrifugal pumps are of the double suction type, specially designed for high efficiency service, and direct connected to a 9 and 17.5 by 12-in. Harrisburg tandem-compound noncondensing

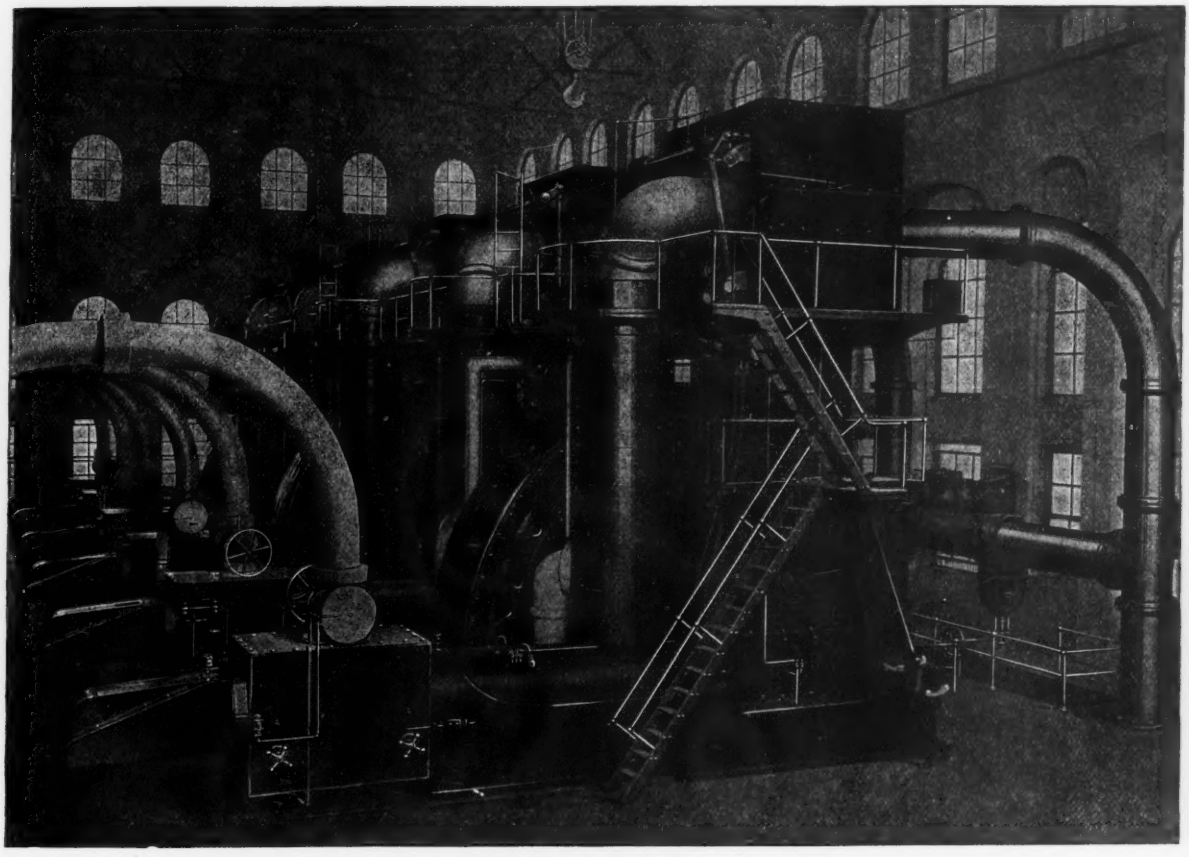


FIG. 4. M'INTOSH AND SEYMOUR ENGINES DRIVING GEN ERAL ELECTRIC GENERATORS

piston valve engine. The limiting speed of this engine is controlled by a throttling governor, while an adjustable eccentric enables the economical setting of the point of cutoff in the engine.

Feed Water Heater

There are 3 Goubert vertical auxiliary feed-water heaters of the multiple-flow type, each containing 1000 sq. ft. of effective tube heating surface. The supply of exhaust steam is such that under practically all conditions of load, all of the exhaust from the auxiliaries is utilized within these heaters.

Fuel Oil Plant

Fuel oil is stored in large steel tanks having a capacity of 30 to 45 days' supply. The oil is pumped

FIG. 2. PLAN OF REDONDO STATION BOILER ROOM

into auxiliary tanks outside the building at 1 end of the boiler room, each tank having a capacity of 1000 bbl. The top of the auxiliary tanks is on the same level as the boiler room floor line, to conform to the Underwriters' requirements. The grade line is about 14 ft. above the floor of tanks, and the surrounding earth is held back by means of circular retaining walls, making tank pits which are roofed over and properly ventilated.

All pipes connecting to these tanks have valves located on the boiler room side, there being a 5-ft. concrete wall between the tank compartments and the operator, and fire partitions between adjacent tanks with fireproof connecting doors. The manhole covers in each tank are padlocked, so that it is impossible for an operator to set fire to any of the tanks as finally designed, although a fire did occur before these precautions were finally adopted.

Instead of steam smothering pipes leading to the interior of the tank compartment, above each tank is placed a steam ring of 4-in. pipe, having an ample number of jets to provide a sheet of steam which would effectually cut off any supply of air from the outside, and promptly smother a fire which might be started by any possible means.

As originally laid out, a duplicate set of oil feed pumps was provided for each unit, or 6 oil pumps in all. The plant is so far operated in this way, but it is now being remodeled to have 1 set of pumps to supply the entire station, requiring but 1 pump operator instead of 3 on each shift. An automatic system of regulation is employed, invented by J. R. Atchison and C. R. Weymouth, the patents for which are controlled by Chas. C. Moore & Co.

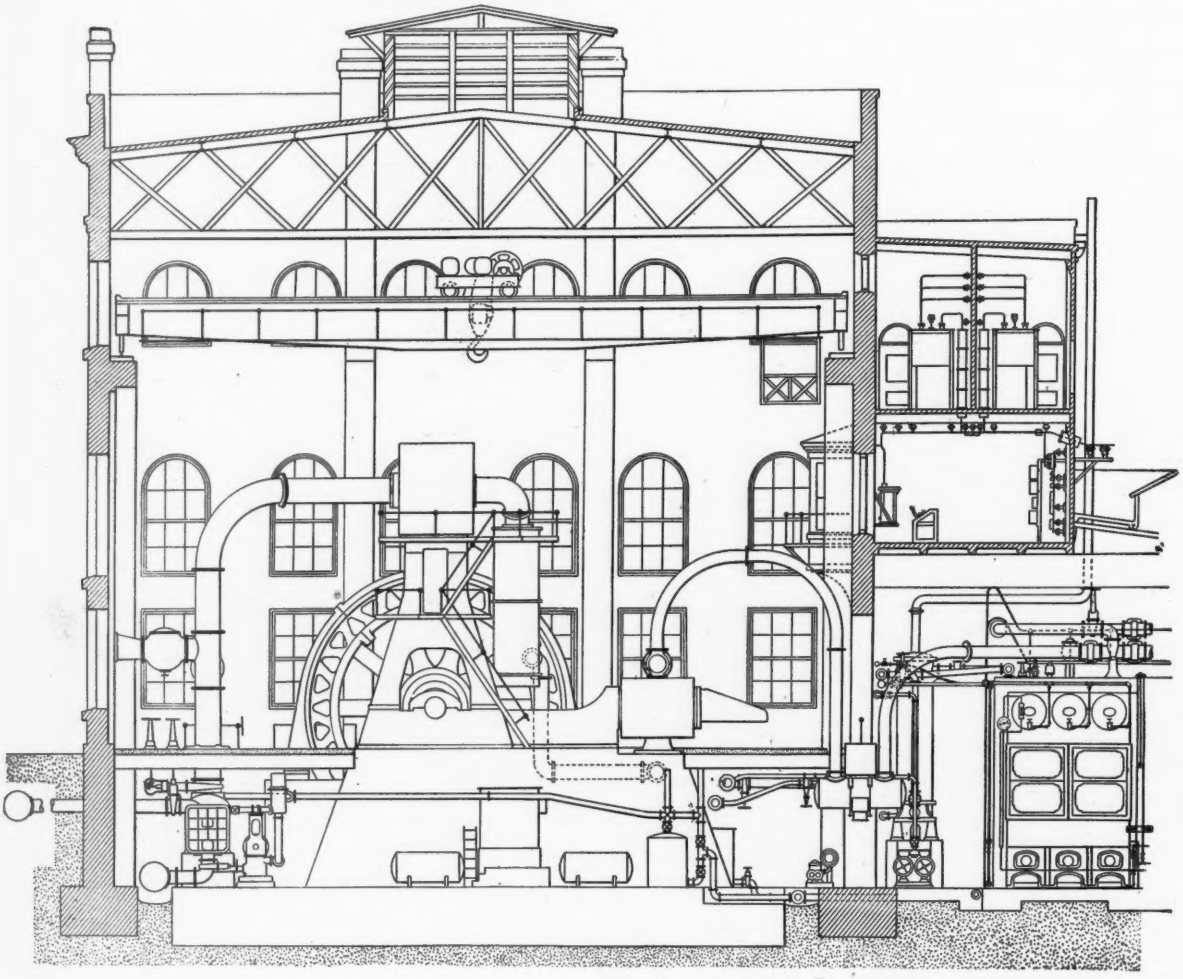


FIG. 6. LONGITUDINAL SECTION THROUGH ENGINE AND

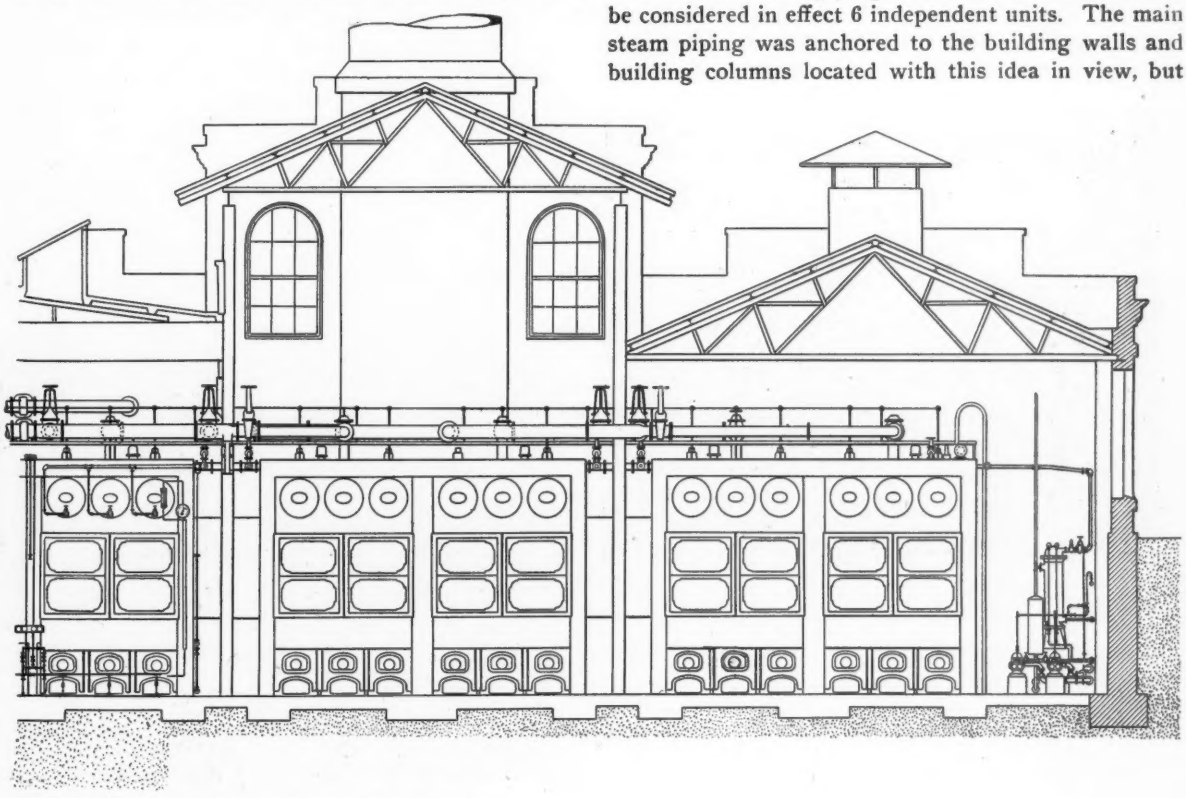
The oil is pumped under pressures varying from 10 to 50 lb., depending on load conditions; there is a uniform oil pressure throughout all portions of the plant, all burners being wide open or nearly so. The amount of oil burned, with variations of load, is controlled by the pressure of oil at the oil pumps, the intensity of fire increasing and decreasing in all boilers simultaneously.

The oil pressure is automatically controlled by a steam pressure regulator, the variations in oil pressure

and intensity of fire being such as to maintain a uniform steam pressure on the plant.

Steam to oil burners, for atomizing purposes, is supplied by a separate low-pressure main, the pressure in which is automatically controlled by variations of oil pressure in the oil main. In this particular plant, it is found that the proper amount of steam for atomizing purposes is furnished under a steam pressure equal to 3 times the oil pressure plus 30. This relationship will vary with the type of burner used, and relative areas of burner orifices for steam and oil.

The air supply for combustion is controlled by a damper controller, also automatic in its action, which increases the damper opening with an increase in oil pressure and vice versa.



BOILER ROOMS, BASEMENT AND SWITCH GALLERY

Feed Water Filters

The air pump discharge is pumped through 6 Day marine-type feed-water filters, in which the discharge is into the top of the filter, the water passing down through the filtering material and out at the bottom to a stand pipe, maintaining a complete submergence of the filtering material. Owing to the slow velocity of the water through the filter, there is a tendency for any oil, not absorbed by the filtering material, to rise to the surface rather than to be carried on and into the boilers by the downward flow of water.

Piping System

The general arrangement of main steam piping is shown on the accompanying drawings. All the piping of the plant, except for some of the minor auxiliaries, is arranged on the panel system, dividing the plant into 3 independent units. In the layout of this station it was desired to reduce the diameter of steam mains. On each high-pressure cylinder of each engine, the throttle valve is for 14-in. pipe. Owing to the necessity for long radius bends, and the desire for flexibility, it was determined not to employ any steam pipes over 14-in. diameter, and it was finally decided to connect 3 boilers in each battery to each side of each unit; thus providing great flexibility of service without increasing the cost of the piping system; hence, so far as the main steam piping is concerned, the plant can be considered in effect 6 independent units. The main steam piping was anchored to the building walls and building columns located with this idea in view, but it was found that the columns were not sufficiently rigid for anchorage purposes, and it became necessary to install a cross system of bracing from wall to wall. Drainage is afforded by locating a large receiver drum in each line of piping, as shown in the drawing.

As but a moderate degree of superheat is required, the valves and fittings are of semisteel, with bronze mountings, and Detroit-Edison necks to prevent leakage of steam around valve spindles, etc. Chapman Valve Mfg. Co.'s valves were furnished throughout the plant.

Special thought was given in the design of exhaust piping to provide the most direct course from the engine to the condenser, so that but 1 bend is used between the engine exhaust outlet and the condenser inlet, and this is of exceptionally long radius. Ex-

haust pipes have been made of large diameter to lower the velocity of exhaust steam and under actual test the loss in vacuum between the condenser shell and exhaust nozzle was at all times less than ½ in. mercury column.

In the pump pit has been installed an underwriters' fire pump, fitted for salt water, and which also serves as a pressure pump, furnishing water for the Lagonda power driven tube cleaner for boiler cleaning purposes.

Cooling Main Bearings

For providing circulating water for cooling the main engine bearings and guides, which are hollow, designed for such cooling, a set of circulating pumps and intercooler have been furnished. Fresh water is

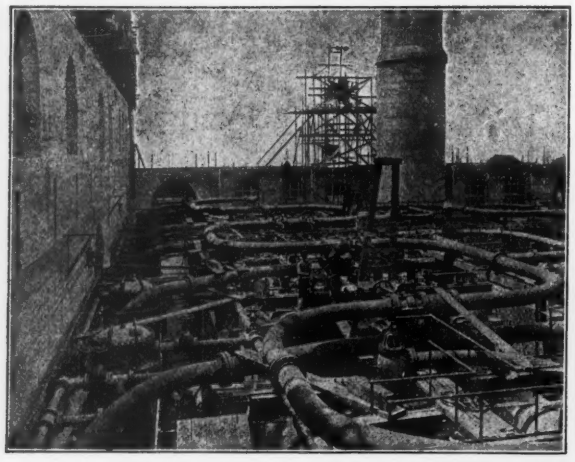


FIG. 7. BOILER ROOM PIPING UNDER CONSTRUCTION

circulated through the engine parts, and is cooled by means of a small surface condenser, the fresh water for cooling flowing within the tubes and salt water taken from condensing water suction mains being circulated around the tubes.

Chimneys

Two reinforced concrete chimneys, built by the Weber Company, each 13 ft. diameter and 125 ft. in height, have capacity for 2 units each, the plant being so arranged that a fourth unit may be added to the station and connected to the second chimney.

The chimney gases pass from boiler to chimney through specially designed reinforced concrete flues, which have proved satisfactory for the work.

Foundations

The plant is installed on the beach within a few hundred feet of the surf line, where the subsoil consists largely of drift or pit sand. In order to prevent vibration due to the main engines, the design of subfoundation was carefully studied, and it was determined that in place of piling, a subfoundation should be constructed, 6 ft. in depth, covering the entire length and width of the engine room, except a 2-ft. space all around, left to prevent interference with building foundations.

This slab is reinforced top and bottom at the critical points, and the main engine foundations are built directly on top of this slab, rising 14 ft. to the engine room floor line. Foundations for exciter engines were made by arches over the space between adjacent units, suitably strengthened with reinforcement, thus affording ample space underneath for rheostats, filters, etc.

One of the difficulties yet to be solved by the Pacific Light & Power Co. is the elimination of seaweed, and more particularly the fine sea moss from the circulating water, which fouls the condensers and gives rise to a frequent loss of vacuum, compelling operation noncondensing. It is impracticable to handle this effectively with any type or make of enclosed strainer, and it is probable that some type of open canal screens will be used to overcome this difficulty.

Guarantee

The contract covering this station embodied an economy guarantee providing for a 90-days' test of 1 unit on a commercial railway load, under any load curve within the limits of the rated capacity of the

FIG. 8. ARCHES FOR EXCITER ENGINE FOUNDATION

generator, the total output being not less than 60,000-kw. hr. nor more than 78,000-kw. hr. per 19.5 hr. running, there being 4.5 hr. standby each day.

On this load the company guaranteed an economy of 170 kw. hr. per barrel of oil, each barrel weighing 334 lb., each pound containing 18,500 B. t. u.

The test committee's report gave the result of the 15 days' test finally made as 252,842 kw. hr. per barrel of oil, a record in the economy of large power plants, operating under commercial conditions. For purposes of comparison, the above economy is equivalent to slightly less than 25,000 B. t. u. in the fuel per kilowatt-hour net output of plant.

The bonus earned as a result of the above economy was $363,310, which is probably the largest bonus ever paid on a steam power plant guarantee.

QUESTIONS AND ANSWERS

Our readers are invited to send in their troubles and problems; also to answer questions which are asked. All letters must have name and address of writer, which will not, however, be published. If answers are wanted by mail, send stamp for reply.

Commutator Repair

I notice in the September issue of the Practical Engineer that J. E. A. requests some one of the readers to recommend a filling to go between the segments of a burnt commutator. His proposition is one I have been up against a number of times myself and I gladly recommend one of a number of methods which I use for such cases and one which has never failed me in a single instance in the last 4 years, when used on 220 and 500-volt machines.

First, clean the cavity thoroughly, and scrape the mica insulation to insure that all burnt particles are removed, thus obtaining a distinct separation between the segments. Heat a small quantity of fine powdered pumice stone to drive off all moisture. Take a little gum shellac in flake form and dissolve it in alcohol, using only enough of the latter to dissolve the shellac.

Now mix the powdered stone with the shellac to the consistency of putty. Force this into the cavity, being sure to fill it entirely. If possible, the armature should now be baked or the mended portion kept covered with a hot sand bath; but if the job is done on Saturday evening, the machine should be ready for service Monday morning.

When the substance has hardened in the commutator, dress up with a mill file. Byron A. Fay.

In regard to the request by J. E. G. for a filling for commutators, in the plant where I am employed we use a paste made of plaster of Paris and shellac, or one made of silicate of soda solution, and plaster of Paris. The cavity between the bars must be well cleaned and the paste tamped in and allowed to dry before using the machine. The soda solution is the better, as it will stand the heat better; it can be procured from dealers in gasfitters' supplies. It is the solution used to stick mineral wood or asbestos on the back wall of gas grates. Fred Evans.

There are 3 things that J. E. G. can use for his commutator trouble: 1. Glycerine and litharge made into a paste; 2, ground mica and shellac made into a paste; 3, plaster of paris.

Of these three I have found plaster of Paris the best and quickest to work, but any one of the 3 will answer for this purpose. W. H. D.

J. E. G., in Sept. 1st Practical Engineer, desires a remedy for repairing a commutator. The writer has had the same trouble on 2 200-kw. dynamos, and have remedied them by the following recipe:

A paste made of air slacked lime and the white of an egg.

The slot should be thoroughly cleaned and the paste pressed in the slot and let dry. C. E. N.

States and Cities with License Laws

What states have license laws, and what cities have license ordinances in states where there are no state laws?

A.—The states having license laws are Massachusetts, Minnesota, Montana and Ohio. The cities outside these states which have ordinances are New Haven, Conn., Yonkers, Poughkeepsie, Buffalo, Rochester, Niagara Falls and New York in New York State, Philadelphia, Pittsburg, Alleghany and Scranton in Pennsylvania. Jersey City, N. J.; Baltimore, Md.; Atlanta, Ga.; New Orleans, La.; Memphis, Tenn.; Louisville, Ky.; St. Louis, Mo.; Peoria and Chicago, Ill.; Sioux City, Ia.; Denver, Colo.; Tacoma and Seattle, Wash.; San Francisco and Los Angeles, Cal.; Detroit and Saginaw, Mich.

Difference Between Steam and Water Pressure

J. S. R.—If a boiler is tested with 80 lb. water pressure, what steam pressure could it stand? Should a boiler burst under water pressure, would it do much damage?

A.—The rule for hydraulic test of boilers varies in different cities. In some places the hydraulic pressure is carried up to 1½ times the steam pressure, and in some places, 2 times the steam pressure. Usually, 1½ is sufficient; hence, if the boiler is tested with 80 lb. water pressure, it should be safe for 50 lb. steam pressure. This, however, is not a conclusive test, since there may be weak spots in a plate which the hydraulic pressure will not reveal.

If a boiler bursts under water pressure, the water being not over 212 deg. F. in temperature, there would be no dangerous results. The water would simply rush out at the leak.

Friction Brake Band

Would it be of any advantage to widen a 3-in. brake band to 5 in. to prevent heating the drum? This is on a hoisting engine. And is there anything better than leather to put on a band? B. F. M.

Raising a Gin Pole

Will some reader kindly give me a good practical way to raise a long gin pole? H. A. F.

LETTERS FROM ENGINEERS

Send us descriptions of ways of doing new things, and new ways of doing old things. Rough pencil sketches and letters are all right; we will fix them up for the printer. All accepted contributions will be paid for when published.

Novel Construction of Open Feed-Water Heater

On taking charge of my present steam plant, I replaced 3 old 2-flue boilers 48 in. by 22 ft. with 2 tubular boilers 72 in. by 18 ft. with 72 4-in. tubes.

The heater consisted of a lot of 1.25-in. piping put

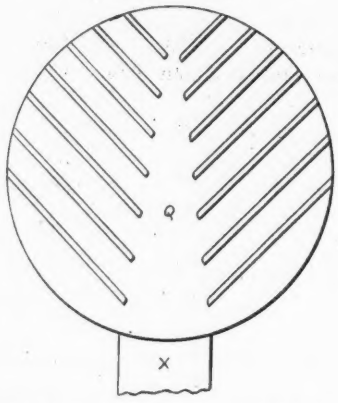


FIG. 1. FIRST BAFFLE PLATES IN FEED WATER HEATER

inside of an old iron tank, and taking up all the available space in the engine room. One of the old boilers

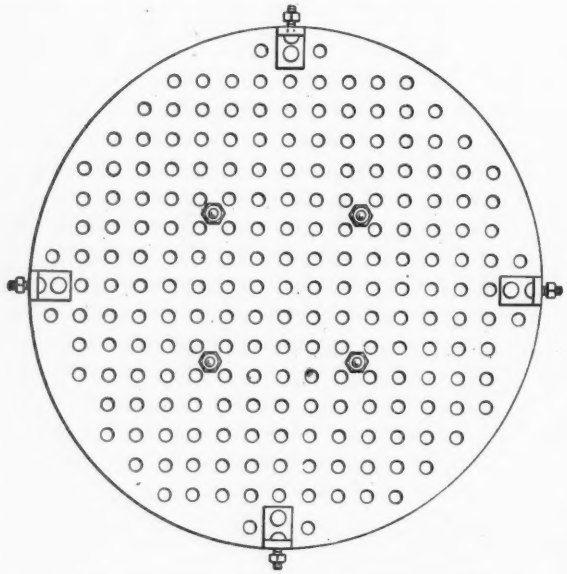


FIG. 2. SECOND BAFFLE OF OPEN HEATER

was converted into an open heater, by removing the 2 15-in flues and bolting a patch over the holes made by the removal of the flues. This heater was raised and set up over 1 of the main engines near the roof of the engine room where it is entirely out of the way, besides giving a good head of water to the hot water pump, helping the pump to work full stroke and to move smoothly.

This heater has been in operation for 10 years and always giving perfect satisfaction. A glance at the cut will show the large capacity for heating, filtering, settling, and oil extracting, besides having a large body of hot water to draw on to fill the boilers, after the engine and cold water pump have stopped for a day. The heater is usually emptied of the water that

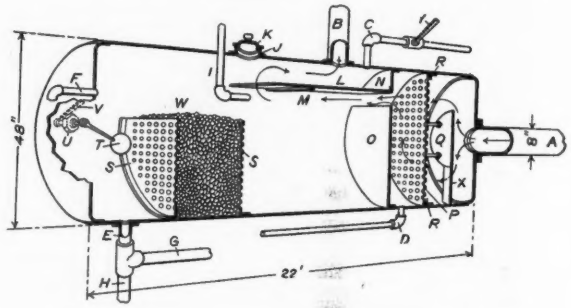


FIG. 3. LONGITUDINAL SECTION OF THE HEATER

is left from the day previous before starting which tends to wash out the heater and pipes. The heater is refilled as soon as the engine and pump are started again.

Referring to Fig. 1, Q, is the first baffle plate 16-in. in diameter made of 0.25-in. iron or steel plate with 0.5-in. square iron riveted to the plate with a path XX, left for the oil to run down as it is caught by the 0.5-in. square irons. From this plate a piece of heavy sheet iron is riveted on the back and reaching to the bottom of the separating chamber as shown in Fig 3. Figure 2, shows the second baffle plate made of 0.25-in. steel with ⅞-in holes punched in line with each other, leaving a blank space of 1.25 or 1.5-in. as a pathway for the oil and water to run down to the bottom of the separating chamber. These plates are made in halves in order to get them into the shell, and are afterward bolted together. Both the large and the small baffle plates are bolted together with 3 0.5-in rods, with the nuts screwed on the rods on either side of the plates, thus making the 2 as 1; and the whole is made fast to the shell with 4 lugs and bolts. In Fig. 4 O, is made of 0.25-in. material flanged 2 in., and is bolted to the shell as shown in Fig. 3. O is

made 1 in. smaller than the shell to make room for waterproof cement to be driven between the shell and the flange. N is put on in the same way.

L is 2 pieces of heavy sheet iron of the proper width and length laid on the flange N and made fast with 2 bolts. M, is a bar of iron made fast to the shell to hold the sheet iron. S in Fig. 3 is also punched sheet steel; 2 of these are bolted together about 3 or 4 ft. apart, and the space filled with coke or brickbats. T is a 10 or 12-in. copper float to regulate a butterfly valve in the cold water supply pipe. U is a bonnet from an old 3-in. gate valve bolted to the shell with

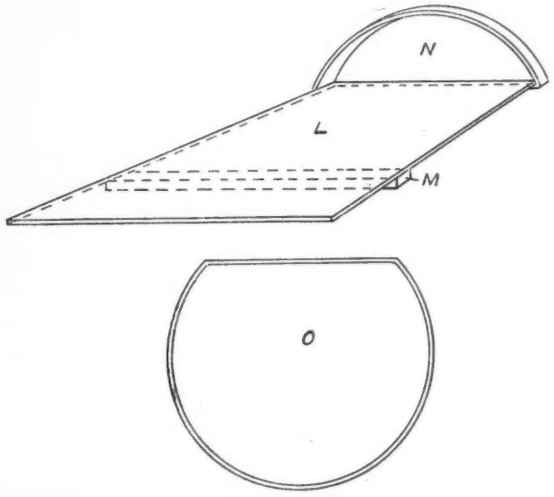


FIG. 4. FRONT HEAD OF WATER COMPARTMENT

the float connected inside and the lever V outside. F is a 2-in. overflow pipe. I is a drain pipe from the traps and elsewhere.

Should steam leak through any of the traps or bleeders it will help to heat the feed water besides returning the condensed steam to the boilers. J is the manhead frame and K, the outside cover, with a soft packing between. A is the exhaust inlet and B, the outlet. D is a 1.25-in drain pipe. E, and G, are hot water pipes to the boiler feed pump. E and H settling and blowoff pipe. Y and Y, is the wire to connect the float to the butterfly valve.

This heater should be set on an incline of about 4 or 5 in. so that it will wash out and drain better.

S. P. Morrison.

Feed-Water Regulator or High and Low-Water Alarm

It is surprising to find so many engineers and firemen who do not distinguish between a device for high and low-water alarm and an automatic feed-water regulator. Most feed-water regulators have a high and low water alarm, but many high and low-water alarm devices are not feed-water regulators. Time was that a high and low-water alarm was of some value, in some cases a little better than others; but with the advent of feed-water regulation the alarm is not so essential.

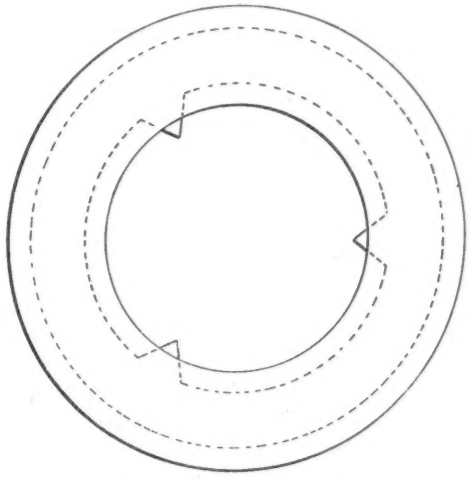
A good feed-water regulator is a valuable safeguard, as it helps to prevent boiler explosions and the knocking out of engine cylinder heads with water from the boiler. With the high and low alarm the whistle blowing, more frequently denotes high than low water, which means running the engine with wet steam; frequently the water goes over into the engine.

On a good feed-water regulator the whistle should blow only when the regulator is out of order, while without the regulator it most frequently blows because the fireman neglects to watch his water. The alarm alone is no saver of coal or strain on the boiler or an engine. The regulator is both a coal saver and a boiler and engine protector. P. S. F.

Curing a Piston Noise

In a recent number a correspondent complained of a slapping sound in the cylinders of his engine for which he was at a loss to know what to do.

This sound is caused by the piston rings striking



COPPER SHIM ON PISTON RING

against the piston follower, due to the wear on the side of the rings making them smooth and leaving some space for play. The trouble is usually found in small engines.

As a simple and permanent remedy, cut a circle from sheet copper slightly smaller than the rings, leaving 3 ears on the inside to bend over the ring. This will keep them in position and prevent interfering with the proper working of the rings.

The dotted lines on the sketch indicate the relative size and the location of the sheet copper on the ring.

Two engines treated in this way resulted in relief from a disagreeable noise.

Another thing which may seem of small moment, but in reality can cause a great deal of annoyance in lock nuts getting loose, as for instance on the valve

rods of an engine. The remedy in such a case is also simple. A washer placed between the nuts, or roughing the sides of the nuts that come together with a chisel; either way will make them stick like grim death.

T. J. Mouat.

Convenient Boiler Blower

I read the article by W. S. Hudgins, the Hand Scale Remover. I will send sketch of a scale remover which is used for blowing out scale by steam. It

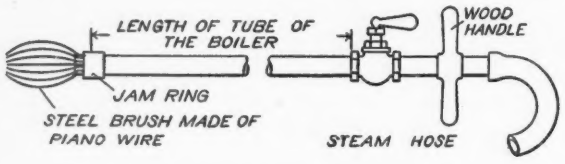


FIG. I. A CONVENIENT BOILER BLOWER

was made of a ½-in. pipe, connected as shown, and is used while the boiler is under pressure.

Gus A. Janicke.

Pounding Engine; Scale Remover

I note in the August number of Practical Engineer that A. R. M. said his 18 by 42-in. engine pounds on both ends. As he does not state the type of engine, I infer that it is a Corliss. As most engineers know, this engine has peculiarities not found in any other class of engines.

Not being on the ground it is a hard matter to prescribe a remedy for all cases; but I will say Corliss engines run better under a good load, from the fact that the reciprocating parts are better cushioned than when running under light load and high steam pressure. In other words, the steam pressure and load on the engine should correspond in order to have the engine run smoothly.

This cannot always be, as in the case of engines doing irregular work, such as in street railway work and driving beaters in paper mills, where the load is liable to change at any time from nothing to full load.

If the pound cannot be heard in the crosshead or crank pin boxes, it is more likely to be in the main bearing, and will sound like a dull thud or jar, which is probably caused by lost motion and insuffiicent compression on the piston.

Some time ago, I was called to indicate a small Corliss engine that had a pound on the head end. After applying the indicator I found there was no compression on that end, the pencil forming a right angle where there should have been a curve. There was some lost motion in the main bearing which caused the pounding. After putting a trifle more lap on the exhaust valve, and taking up lost motion the engine ran quietly.

I would advise A. R. M. to try the indicator, as this is the only sure method of ascertaining the valve adjustments. Adjustments may be made by measurment when the engine is idle, then apply the indicator when the engine is running to check up by.

In regard to W. S. Hudgins scale remover, I think its efficiency depends largely upon how much the tubes are scaled. If only lightly covered, he may be able to remove some of it, but when the spaces between the tubes are completely filled with scale, as I have frequently seen them, it is apparent that this device would have no value as a scale remover.

I think that when the tubes are badly scaled and the scale can not be dissolved by chemicals, it is best to take the tubes out and hammer or rattle the scale off, at the same time this gives a good chance to thoroughly clean the tube sheets and the shell.

Of course, this is an expensive job, but it often pays in the saving in fuel, especially if the fuel is high priced. The removal of the tubes seldom has to be done, depending upon the nature of the feed water and the means taken to prevent scale formation.

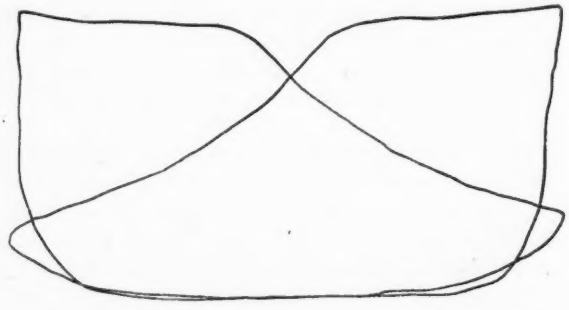
In connection with scale in boilers, especially those that are forced day and night, the writer has learned that it is very necessary that the scale be kept off the rear tube sheet or trouble will occur from leaky tubes and burned heads.

I have tried several home made tools for knocking off scale, and have never had much success owing to the small space one has to work in. About the best thing in that line is a knocker to pass through the tube that is operated by steam, air or water pressure. But I will admit there is some merit in all devices.

L. A. H.

Diagram for Criticism

I am sending indicator diagrams taken from a 24 by 48 in. Corliss engine. A 50 spring was used, steam



pressure 120 lb., 72 r. p. m. The exhaust is used for cooking purposes, hence the back pressure shown. I should like some engineer to pass the planimeter over the diagrams, and give me the m. e. p., also the h. p. developed, with his criticism of the diagrams.

L. A. H.

Construction of a Quadruple Riveted Joint

In regard to the question in the April issue of Practical Engineer, page 25, question 19, a subscriber desires information, and I submit the following drawing of a quadruple-riveted, double butt strap point, with 8 rivets in double and 3 rivets in shingle shear. This design gives an efficiency of 94 per cent of the original plate, making it the strongest type of joint known to boiler makers when correctly proportioned.

In regard to the rivets in double and single shear,

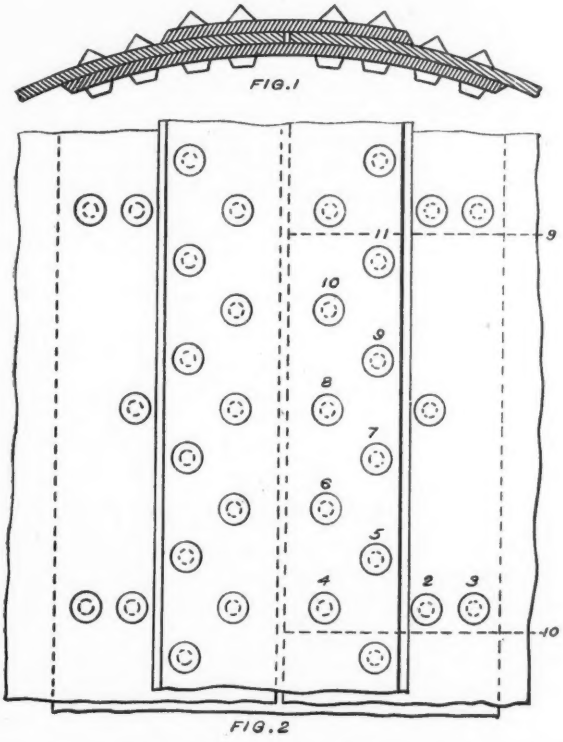


FIG. 1. SECTION OF QUADRUPLE RIVETED DOUBLE BUTT STRAP JOINT

FIG. 2. SIDEWISE VIEW OF QUADRUPLE RIVETED JOINT

a word of explanation may be of assistance. It will be seen from Fig. 1, that the 2 outer rows of rivets go through only two thicknesses of plate: namely, the inside strap and the boiler plate. To shear, the rivet will have to be cut once. Thus the rivet is said to be in single shear, the strength of which is taken as 42,000 pounds per square inch of cross sectional area, according to the Massachusetts Board rules.

The 4 rivets in the center of Fig. 1, go through 3 thicknesses of plate, the outside strap, the main plate, and the inside strap, and are said to be in double shear. This is because the rivet will have to be cut twice in shearing. The assumed value of the rivet when in double shear is 1.75 to 1.85 times the shearing strength of rivets in single shear.

Let us take Fig. 2, for instance, and see what we have. That portion of the joint within the dotted lines 9 and 10, Fig. 2, represents the section of the joint under consideration.

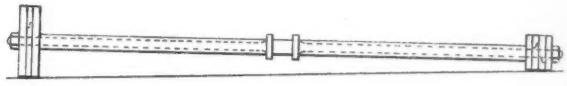
We shall find that the 2 outer rows of rivets in this section are in single shear, as will be seen in Fig. 1, being marked in Fig. 2; 1-2-3. This makes 3 rivets in single shear. Fig. 2 shows the rivets 4 to 11 in double shear, going through 3 thicknesses of plate as in Fig. 1. This makes 8 rivets in double and 3 rivets in single shear.

This joint differs from the triple riveted butt strap style, from the fact that it has 1 extra rivet in single shear, and 4 more rivets in double shear, in a given plate section. The inside strap is made of sufficient width to take in all rows of rivets. This type of joint has an efficiency about 10 per cent greater than the triple riveted double butt strap joint.

A. C. Waldron.

Pump Repairs

Upon taking charge of a plant in Chicago, there was a 6 by 4 by 6-in. Worthington pump which I was informed would always stop at the plunger end of



stroke, and if given steam enough to overcome this it would run too fast and flood the boilers. I found this was caused by the pump rods being worn down 1/32 in. therefore leaving a shoulder upon the part of the rod that did not enter the packing. After asking for some packing that would not cut the rods in this manner, I found that the engineer had little to say in the packing line. The superintendent had a friend in the packing business whose goods according to his idea were the best on earth and—the superintendent did the buying.

This packing would get so hard in the stuffing box that you had to take a cold chisel and hammer to remove it.

Well, I knew it was up to me to use this packing and upon asking for new pump rods, I was told they were new 6 months before and should last at least 1 year.

I removed the rods from the pump and had them turned down 1/32 in. leaving the crosshead or spool as it is sometimes called upon the center of the rod. I then got some seamless brass tubing 1/32 in. thick, and the correct size to fit the rod and then drove it on from each end up to the spool, getting it the exact length so as to shoulder against the piston.

This gave me practically new rods for about 30 cents each outside of my labor. I found this tubing would last about a year before it was worn through, and after the rods were turned down, it was a small matter to replace them.

At another time I was running a pump that had the old kind of stuffing box as shown in Fig. 2, when

one of the studs broke off next to the cylinder. This pump had to run till we shut down at the end of the week.

It was kept going by placing a block of wood back of the good side of the gland as shown in Fig. 2, this

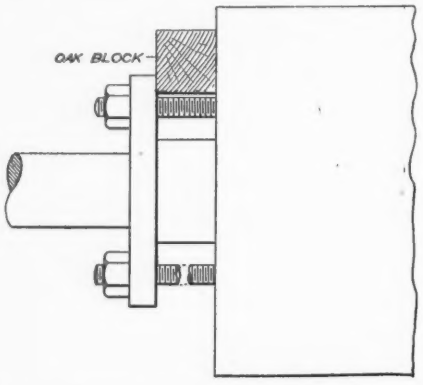
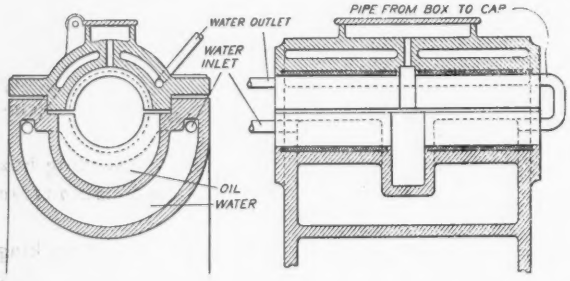


FIG. 1. BROKEN STUD AND TEMPORARY REPAIR

block kept the gland square the remaining stud acting as a fulcrum. James Browning.

A Cool Running Bearing

An acknowledged bad practice is to allow journal bearings to become so hot that the heat generated by friction should be taken care of before it can interfere with the operation of the machine or the entire plant. Journal bearings rightly designed, adjusted



and lubricated should run indefinitely without necessitating an attendant to apply additional cooling ingredients, such as sulphur, graphite, salt, water or ice.

Incidentally, when a bucket brigade was kept busy in flooding a bearing with cold water, so as to keep the babbit metal inside the box, the accompanying design of a ring oiling water cooled bearings was suggested and adopted, the box being altered accordingly. This change proved to be more effective than expected. The bearing which ran hot before, at about 1300 r. p. m., showed no sign of running hot when the speed of the shaft was increased to nearly 2000 r. p. m. Ulrich Peters.

A CUBIC FOOT of cast-iron weighs 480 lbs.

Electric Furnace

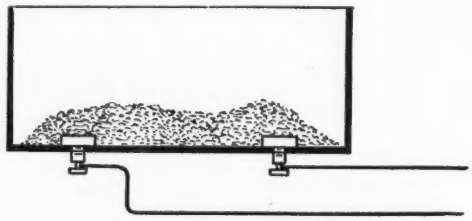
A convenient electric furnace can be made in the following manner:

An ordinary sheet iron basin is lined inside with asbestos mill board.

Two binding posts for wire connections about 6 in. apart are each connected to a small carbon, which runs through the bottom of the pan.

Granulated carbon can now be placed in the bottom about 1 or 2 inches deep. When the current is turned on a very intense heat can be raised.

It is advisable to have some resistance coils in the circuit for which iron wire can be used, and throw



HOME MADE ELECTRIC FURNACE

them in as the heat increases, as of course, the hotter the carbon gets, the more current it will take.

F. T. Flenniken.

ALUMINUM CONDENSER TUBES

In many localities, brass and copper tubes in condensers are corroded by sulphuric acid and other chemicals so that their life is very short. One large establishment has been obliged to resort to pure copper, which is, of course, very expensive, but the expense has been found warranted by the extra life of the tubes. Experiment has shown that a tube made of copper, covered with aluminum so that the cooling water does not touch the copper, has much longer life than even the pure copper, due to the fact that sulphuric acid does not attack aluminum. The bimetallic tube is better than either copper or aluminum, as after the water has eaten through the aluminum coating, which it will do in the parts where there are slight impurities, the galvanic couple formed by the aluminum and copper protects the copper from corrosion. These tubes are made in all the standard sizes used in condensers, and on account of the high conducting power for heat of aluminum and copper, are superior to brass.

FOR 1907 THE COAL PRODUCTION was the greatest on record. The largest output was that of Pennsylvania, which gave of anthracite 76,432,421 long tons and of bituminous 394,845,730 short tons. Illinois was second with a total of 51,317,146 tons, and West Virginia third with 48,091,583 tons. The total coal output of the country was 480,450,042 tons, showing a value of $614,831,-549.

THE NATIONAL CONVENTION OF STATIONARY ENGINEERS AT DENVER, SEPT. 7 TO 11.

Gathering the Clans

A WEEK before the really appointed time, out of town exhibitors and engineers began to appear on the streets; but they were few and most of their time was spent outside of Denver in the beautiful trips which reach out on all sides.

On Sunday the 6th the real convening began, Kansas City showed up with a goodly number and a considerable delegation dropped in from the east on the evening trains. Then with Monday, first came the train from the far east, New England, New York and intermediate points; a little later the bevy from Cincinnati and then the Los Angeles bunch from the far west; and in time for dinner the Illinois train completed the gathering in time for Monday evening's reception. The halls of The Albany looked like a convention. On all sides were seen smiling faces and heard boisterous greetings and calls to "see a man" while the joyous destruction of the last of the season's crop of straw hats went merrily on.

Not far from this madding crowd the music of the band furnished by the California delegation and the murmur of womens' voices furnished a counter attraction in the reception room. And at the end Mr. Armour entertained with his usual felicity.

So closed happily the first day of the convention.

During the day, saw and hammer, muscle and ingenuity with the help of language had been at work in the exhibit end of the great Auditorium building putting into shape the best exhibit ever held for the association. Wide aisles, uniform height of signs, and the 70 ft. of head room fixed everything in fine shape to be seen readily and to form an imposing spectacle. By night nearly every booth was in order, and the old Sun dropped behind the Rockies' peaks leaving a lot of tired but satisfied exhibitors and all things ready for the morrow's grand opening.

An Alarm

Not for an uninterrupted night's sleep, however, Just before the grey of the dawn came the always fearful cry of Fire! Help! and from across the street from the Albany, the flames shot through the roof of a smaller hotel; from the gloom of the smoke cloud came the cries and forth from windows and doors leaped the victims of the disaster. With the arrival of the fire department the flames were shortly in hand but the thought of the lives lost and injuries sustained saddened the proceedings of Tuesday, and lent especial meaning to the memorial services later. The leaping flames, belching clouds of smoke from which sprang forth the shrieking, bewildered inmates was a sight which must remain as a vivid although regrettable memory among the week's experiences.

The Opening Session

At 10:30 Tuesday morning the band, which was furnished for the week by the California delegation, began the exercises with an overture and at 10.45 Chairman Carl Pearse, of the local Denver committee called the convention to order and presented Rev. George B. Vosburgh, who invoked God's blessing on the work of the assemblage.

Following a short address by Chairman Pearse, Governor Henry A. Buchtel was introduced and extended his welcome to the visiting delegates, assuring them of the interest which Denver always took in its visitors and of the courtesy which they would receive from the people of Colorado. Response was made to this by President Carney, who expressed the appreciation of the association and outlined the policy which had made the association successful for 26 years and promised to continue its success.

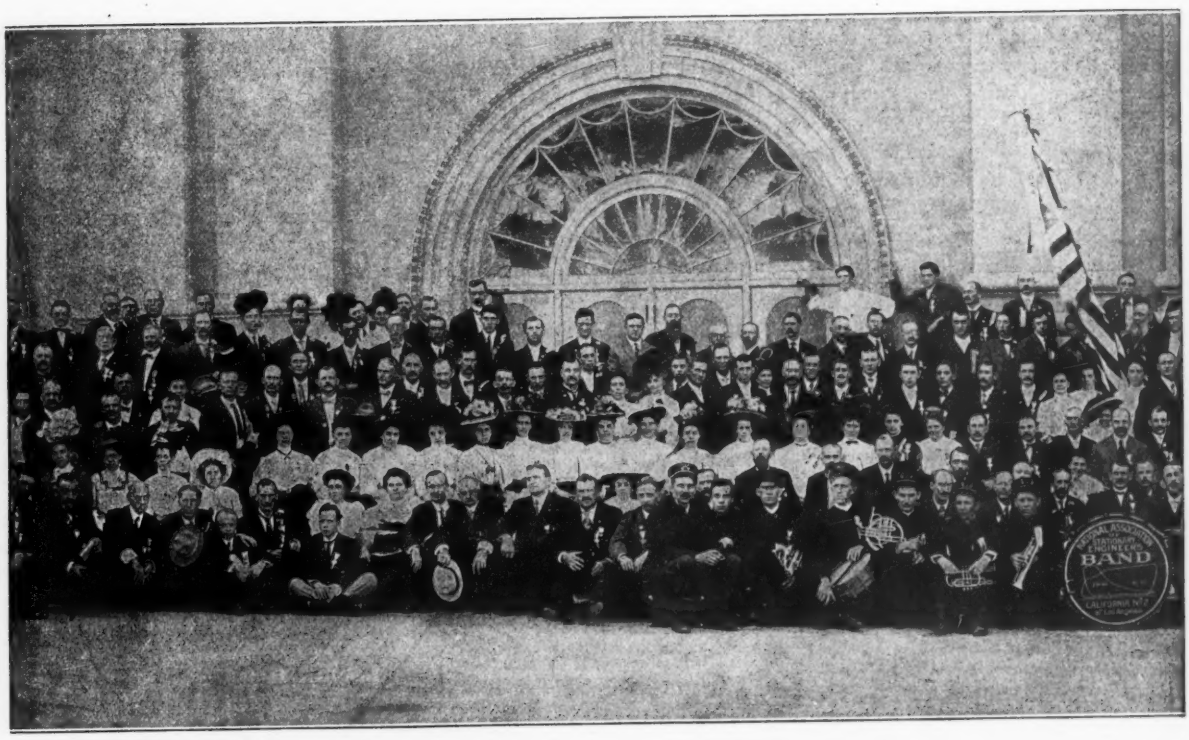
It had been expected that Mayor Robert W. Spear, of Denver, would address the convention, but in his absence W. W. Downing gave welcome and praised the association for its spirit of helpfulness to members and protection to life and property. Tribute was paid to the local members of the N. A. S. E. and to their standing in the community, and the beauties of Colorado were so pleasingly set forth as almost to tempt the convention visitors to remain permanently.

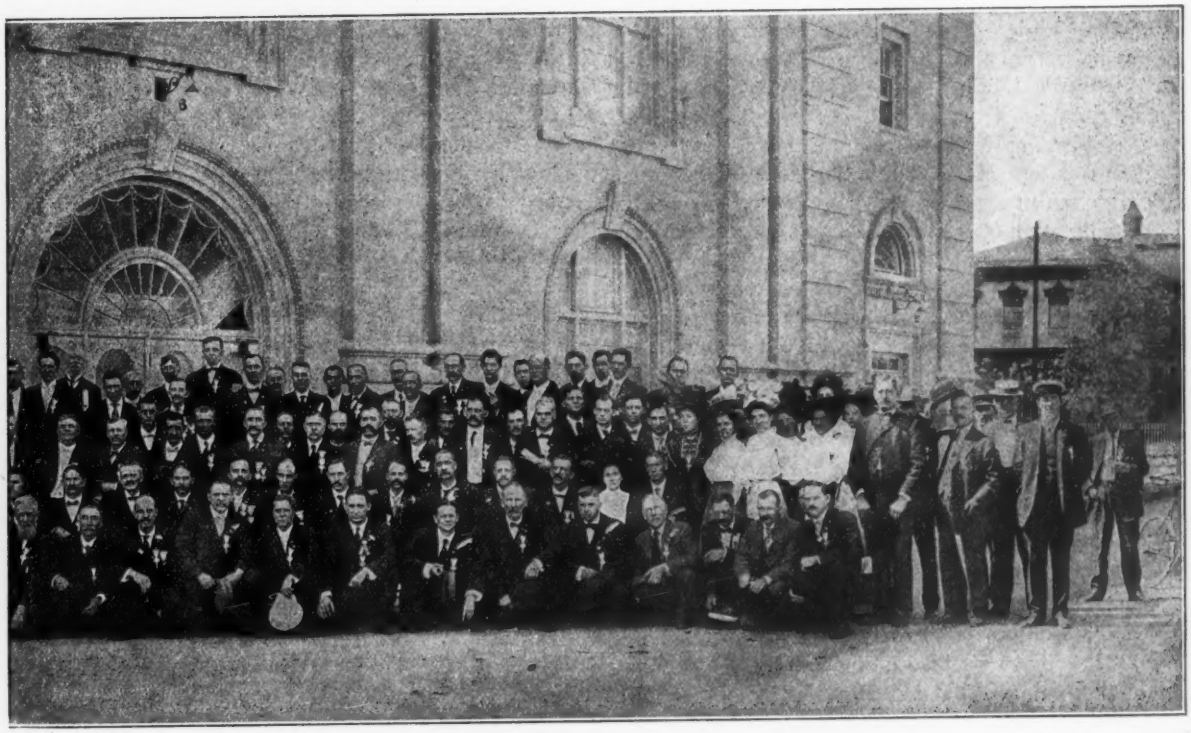
Vice President F. J. Fischer, of California, replied to this welcome, stating his own pleasure and that of the California engineers in having the convention come to the western part of the country. He told of the growth of the association and predicted that the western convention would be followed by a large western increase in membership.

Thomas W. Shears, one of the older members and a pioneer in Denver, drew a sharp contrast between the present condition of the stationary engineer and the conditions in which he worked during his early life. He gave a concise history of the local association from its beginning in 1883 until now. Replying to this, Past President T. N. Kelsey told of the arduous labors of the national president and drew a picture of the neglected wife and family spending weeks alone in order that the organization might prosper. The speech gave some idea of the great amount of hard work that has gone into the success of the organization and of the great amount of credit which is due to those who have faithfully performed the duties of the national offices.

At the close of this speech, after routine announcements, W. T. W. Curl, of Los Angeles, presented to

DELEGATES AND VISITORS AT DENVER





IN FRONT OF AUDITORIUM BUILDING

the national body in behalf of his association a beautiful flag which is surmounted by a spread eagle and the pennants of every state in the Union. This flag formed a conspicious part of the platform decorations during the convention week. President Carney accepted it in behalf of the association and placed it in custody of National Secretary Raven. who accepted the charge and told of the pride that he felt in being honored as custodian of so beautiful a gift.

A silver mounted gavel was presented by the Denver association to President Carney, who then called the convention to order and named committees on credentials, auditing, ritual, mileage, referendum and ways and means.

Afternoon Session—President's Address

The first order on the program of Tuesday afternoon was the annual report of President Carney. He spoke of the difficulties of the president's office and of the necessity for the appointment of suitable aids, recommending that district presidents be provided for, to be appointed by the president and to relieve him of much of the routine work of the association. President Carney does not believe in a permanent officer nor in a salaried president. He thinks that the national president should be an active operating engineer who cannot, of course, give sufficient of his time to the association to attend to routine duties and have any thought left for the more important part of the president's work. President Carney reported a considerable addition to the number of associations and to the membership and that, spite of the unfavorable financial conditions throughout the country, the balance in the treasury was the largest it had ever been. He recommended that $4,000 be left in the treasury at the adjournment of the convention to pay current expenses until other funds became available.

Commendation was made of the work of the educational committee, particularly in the publication of the second volume of "Five Years' Questions and Answers."

It was recommended that in connection with the association paper, the National Engineer, notice should be sent to the present publishers of the termination of contract with December 1909, and that arrangements be made for getting bids on a new form of contract for the publication of that paper, these matters to be in charge of the trustees and the national officers.

President Carney recommended that the per capita tax of associations be extended to cover all members receiving the association paper, whether they be active, honorary or associate. Also that the per capita tax should be made payable in advance. He recommended that the objection of existing associations to the formation of a new association in a county should be subject to review so that this right of objection might not be abused. The appointment of a committee to take up the matter of changes in the constitution during the coming year was recommended.

In regard to the work of district deputies, President Carney emphasized the need of assisting weak organizations as well as forming new ones, and commended the aid extended by state to local associations.

Following the address of President Carney, National Vice President Fischer gave his report, telling of his efforts to arouse the special deputies, secretaries of the subordinate associations and other officers to the importance of active work and complete reports. He told also of the difficulty he had in securing even the reports. He recommended radical changes in regard to the treatment of officers who do not attend to their duties. Because of the absence of about half the quarterly reports, Vice President Fischer was unable to give a tabulated report of the membership.

The committee on credentials reported 344 delegates in attendance.

Membership

Secretary Raven reported receipts for the year of $23,348.93. The number of associations is 364 and the membership in these is 19,607. The leading states in points of membership are New York, Ohio, Pennsylvania, Massachusetts and Illinois. The leading associations in increase of membership are Illinois No. 1, with an increase of 65 members, California No. 2 with an increase of 78 members. Eight associations have each 200 members or over.

After the report of Secretary Raven, the national vice president of the Ladies' Auxiliary was given the privilege of the floor to present the "New Thought" in regard to the assistance of disabled or indigent members. In years past the attempt has been to provide a national home for engineers, but owing to the large amount of money necessary for the purpose and to inconveniences in its administration it is now thought better to make provision in each case of necessity for the assistance of an engineer near the place where he has been living. It is estimated that a contribution of 10c a month from each of 4000 engineers would be sufficient to care for all needy cases that are likely to arise. A committee was appointed to consider the matter and to put these ideas in tangible form for report to next year's convention.

The national treasurer's report showed a balance on hand of $20,382.20 in general and sinking funds and $500 in the protection fund, but it was later ruled by President Carney that as there was some doubt about the validity of the action establishing a sinking fund that all money except the protection fund should be considered as in the general fund and available for all purposes of the association.

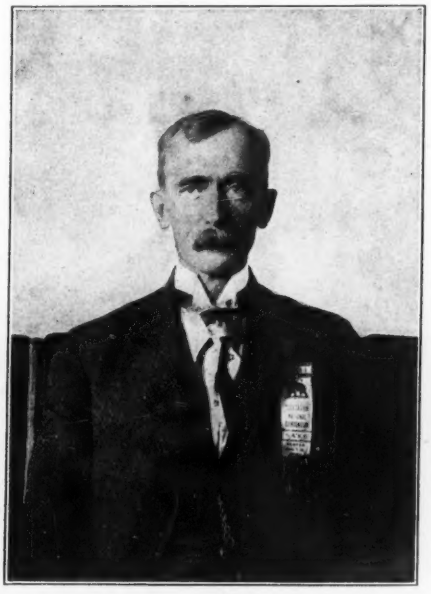
After this report the meeting adjourned until Thursday morning.

Tuesday Evening

Various attractions were running in opposition on Tuesday evening. The Life and Accident Department held its annual meeting, receiving reports of officers. The exhibit in the auditorium was formally opened

and a short entertainment provided by the Exhibitors Association. Tributes were paid by Past President Tomlinson, of the N. A. S. E., to the late president of the Exhibitors Association, John McGilvray, and by Editor John Lane to the Father of the Exhibitors Association, Charles Martin, Jr. The entertainment of the evening was furnished by Herbert Self, of the Keystone Grease Co., Billy Murray, of Jenkins Brothers, and Jack Armour, of Power. After the entertainment the audience returned to the exhibit hall which was open until nearly 12 o'clock.

At the meeting of the Life and Accident Department cash on hand was reported as $6,341.91, $,645 being in the reserve fund and the remainder in the expense and benefit funds. The salary of the secretary-



FRED. J. FISCHER, PRESIDENT N. A. S. E.

treasurer was increased from $1,000 to $1,200 a year. Tribute was paid to the memory of Brothers N. J. Kelley, Charles Martin, Jr., and M. D. Nagle, and various disputed claims were taken up. Those which were in doubt were left for the trustees to act upon. One claim was ordered paid and one referred back for further evidence.

Election of officers resulted in James G. Beckerleg as chairman of board of trustees, Ira Watts as secretary-treasurer, T. N. Kelsey as trustee for 5 years, and P. E. Leahy as trustee for the unexpired term of Mr. Nagle.

Wednesday

This entire day was given up to a trip into the mountains over the Georgetown Loop. The excursion was free to delegates of the N. A. S. E. and Ladies Auxiliary through the courtesy of Colorado Association No. 1, of Denver, and the cost of tickets to exhibitors and visitors was slight. Luncheon was served on the train by the National Exhibitors Association. The train left Denver at 8 o'clock in the morning, running to Silver Plume in 4 sections, where those who wished continued on the narrow gauge road to the top of Mt. McClellan, which is but 100 ft. lower than the top of Pike's Peak. Here, to give realism to the trip, a rain and snow storm was encountered which, while it gave variety to the experiences of the week, was not particularly appreciated by those who had come provided only with summer clothing. Several of those who essayed the overhead cable and bucket route to Sunset Peak are very sure that they are not anticipating the time when airships will be a common means of conveyance. All agreed, however, that the experiences of the trip and the magnificent scenery were well worth while, and were greatly appreciative of the hospitality of No. 1 in providing for this day's entertainment.

Thursday—Educational Work

The work of Thursday was perhaps the most important of the convention. The first work in order after calling of the roll was the report of the educational committee. The continuance of the educational contest was recommended, as its value was believed in, although the number of associations taking part has not been so great during the past year as formerly. The two prizes went to Indiana No. 7, of Evansville, $25, and Missouri No. 5, of Kansas City, $15.

WILLIAM J. REYNOLDS, VICE PRESIDENT N. A. S. E.

One of the important events of the year in the educational line was the publication of "Five Years' Questions and Answers," which is a standard on stationary engineering practice.

The standardization committee recomemnded the adoption of the rules for testing engines which were reported to the American Society of Mechanical Engineers. It was recommended that all operating engineers use these rules whenever possible. As to a standard method of testing refrigerating machines it

was not thought wise to attempt to formulate such a method at the present time.

License Laws

In its reports the license committee censured those engineers who write to members of legislative bodies protesting against the enactment of license laws, such action being in direct opposition to the modern thought of safeguarding life wherever possible. Appointment of examiners on a competitive basis was recommended to avoid the effect of the spoils system. City ordinances have been adopted during the last year by Scranton, Pa., Jersey City, N. J., Oklahoma City, Okla., and some changes have been made in other cities. In Minnesota and in St. Louis there seems to be considerable dissatisfaction with the method of enforcement of the laws. The committee recommended that the national president be empowered to appoint a state deputy for each state who shall have charge of all matters affecting license legislation. This recommendation was adopted.

HERBERT E. STONE, PRESIDENT N. E. A.

Publication

The trustees of the National Engineer reported receipts for the year of $14,177.44 and expenditures of $6,246.19, and payment to the national treasurer of $7,500, leaving a balance on hand of $431.25. They reported that in future an index would be supplied with the paper and recommended that the directory of associations should be eliminated from the paper. This recommendation was, however, laid on the table. The board of trustees was authorized in connection with national officers to receive proposals for publishing the paper for a term of five years, beginning Jan.1, 1910, and submit these proposals to the 1909 convention.

The afternoon session was occupied with receiving the report of committee on analysis, which was referred to various other committees for consideration and reported that the recommendations of President Carney in regard to the appointment of deputies should be adopted, also that the recommendation of President Carney in regard to terminating the present publishing contract with December, 1909, should be adopted and that advertising contracts taken by the present publisher should be made to terminate at that time.

Memorial

The memorial service for deceased members was then held, 119 names being on the roll. During the sessions of the convention crayon portraits of Messrs. Charles Martin, Jr., Nicholas J. Kelley, M. D. Nagle and John McGilvray were hung on the stage draped with crape, and these four members were particularly spoken of in the memorial addresses. The convention adjourned after this service until Friday morning.

WILLIAM G. LE COMPTE, VICE PRESIDENT N. E. A.

Friday

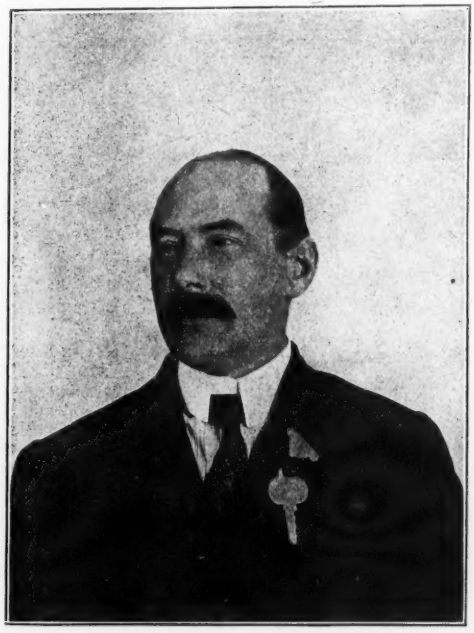
Friday morning was lively. The question of leaving $4,000 in the treasury for working fund came up and ran against the snag of cutting down the mileage and increasing the amount that delegates must pay out of their own pockets for the trip to Denver. The $4,000 was, therefore, not left in the treasury. Various propositions for the payment of mileage came up. The recommendation of the committee was 3.5 cents. Some of the extremists wanted to pay 5 cents and let the association get out from under as best it could. After the expenditure of a deal of oratory on the bad policy of bankrupting the association which was claimed by the extremists on one side, and the tremendous

amount of credit that the association could get which was advanced by the partisans of the other side, it was found that 4 cents a mile one way would still leave the association solvent and this was voted.

Pennsylvania Association No. 20, of Philadelphia, having made amends for its unfortunate misunderstanding of rules, was reinstated and its delegate seated.

University Extension

The Wisconsin delegation presented a set of resolutions stating the advantages of the "Wisconsin idea,"



W. D. PURCELL, SECRETARY N. E. A.

which is to co-operate with the university extension courses of the various universities for the benefit and education of members. The University of Wisconsin has taken up this idea and is ready to give correspondence instruction and to form study courses and provide lectures. Much of this work has been done in the engineering field through the associations of the N. A. S. E. in Wisconsin and has resulted not only in increasing the knowledge of the engineer but in bringing closer together the employer, who becomes interested in this movement, and the general public, who are interested in all educational movements. In consideration of these benefits, resolutions were passed directing the officers and deputies of the association to study this idea, to confer with representatives in the state legislatures and endeavor to have this extension division of the college established in each of the state universities. It was also resolved that circulars and pamphlets bearing the name of the association should be printed and distributed urging the advancement of this method.

Meeting Place

One of the most exciting times in the course of the convention is the hour devoted to the selection of a meeting place for the following year. There is always much partisanship among the delegations from different sections of the country; there is always much speech making and protesting by the representatives of the cities which invite the convention. As a usual thing it is pretty well known beforehand what city is likely to win out. In this convention Columbus, Put-in-Bay, Cedar Point and Sandusky, Ohio, were asking for the convention, and there were also invitations from Detroit, Mich., Binghamton, N. Y., Chattanooga, Tenn., and Seattle Washington. The attractions offered by Columbus and the logic of the situation, as conventions have recently been held well to the east of the country and to the west, so that the

M. B. SKINNER. TREASURER N. E. A.

central section is now deserving of recognition, resulted in the choice of Columbus by a large vote.

Friday Afternoon

This session also resulted in much oratory which was of little service. The resolution was taken up to change the official button from its present size and color, enlarging it and making it red, white and blue. Speeches were made in behalf of the resolution after which the resolution was carefully voted down.

Officers

Election of officers resulted in the choice of Fred J. Fischer, of Los Angeles, Cal., as president, by acclamation.

Two candidates were prominently in the field for vice president, William J. Reynolds, of Hoboken, N. J.,

and John McGrath, of Chicago. Mr. Reynolds was chosen on the second ballot.

Secretary F. W. Raven, of Chicago, may well be proud of the laudatory speeches which were made in renominating him for secretary and of the ovation which followed his election by acclamation. It was evident that the good work which he has done in the past years was thoroughly appreciated by the association and that the delegates have no thought of dispensing with his valuable services.

Samuel B. Forse, of Pittsburg, was unanimously re-elected treasurer, as was also James H. Van Arsdale, of St. Louis, for trustee for 5 years. Thomas H. Cole, of Brooklyn, N. Y., was chosen conductor, and G. H. Kendrick, of Little Rock, Ark., as doorkeeper.

EDWARD G. M'CARTHY, EXEC. COMM. N. E. A.

Adjournment was then taken until evening, when the newly elected officers were installed with impressive ceremonies at the El-Jebel Temple of the Mystic Shriners of Denver, before the opening of the reception and ball.

The installation was performed by the grandfather of the association, James G. Beckerleg, and at the close of the installation the retiring president, Joseph F. Carney, was presented with a gold past master's jewel and Mrs. Carney was presented by the N. A. S. E. and the Exhibitors Association with a service of silver and cut glass which was sufficiently large and brilliant to repay almost any woman for such sacrifices as the president's wife is forced to make. Mr.

EXHIBITORS' ASSOCIATION REPRESENTATIVES

Carney, who by that time was Past President Carney, expressed the gratitude of himself and his betterhalf for the remembrances, and the convention was then adjourned.

The National Exhibitors Association

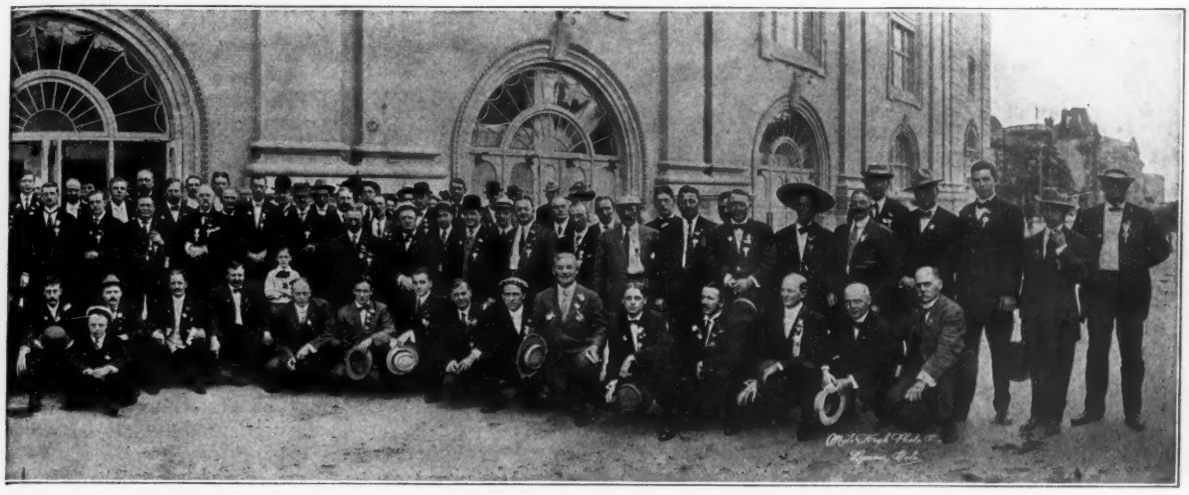
As is the case with most organizations the work of the National Exhibitors Association is done largely by its officers and committees. Tuesday evening a brief meeting was held at which a nominating committee was appointed, also one to take up the question of a proper series of resolutions on the death of the late president McGilvray. On Wednesday the nominating committee posted its report of officers and that evening a member's ticket was posted, which for the most part contained the same names.

The annual meeting of the Exhibitors' Association was held on Thursday evening, by custom, and after a lively contest the following officers were elected: President, Herbert E. Stone, of the Chapman Valve Co., Indian Orchard, Mass.; vice president, Wiliam J. Le Compte, of Jenkins Brothers, New York City; secretary, W. D. Purcell, of the Quaker City Rubber Co., Philadelphia; treasurer, M. B. Skinner, of James McCrea & Co., Chicago. Executive committee: Herbert Self, Keystone Grease Co., Philadelphia, W. D. Rigdon, Revere Rubber Co., Boston and Edward McCarthy of the Geo. W. Lord Co., of Philadelphia.

The committee on resolutions reported and their report was adopted, also F. R. Low was appointed to present to Mrs. Martin the resolutions on the death of Ex-President Charles Martin, Jr. Accompanying the resolutions sent to Mrs. McGilvray will go a substan-

tial fund in place of the service of cut glass which is usually presented to the retiring president. A handsome service was presented to C. K. Thomas, of the D. T. Williams Valve Co., who has been acting as president during the past year.

Constitution and bylaws were adopted after some discussion, providing for the election of officers in the future by ballot on the Australian system, the regular ticket being provided by nominating committee, and members' tickets by the nomination of 10 members. The secretary and treasurer will in future give bonds, the expense of which will be borne by the association and membership in the association will carry the right to one vote on all subjects which come before the association.



DELEGATES AND VISITORS AT DENVER

The constitution also provides for the holding of regular and special meetings by call of the president or of 25 members and for the regular operation of such simple machinery as is necessary in the handling of the association affairs. The National Exhibitors Association is now the third in rank among such associations in the country and bids fair in a short time with the increase of importance of the conventions, to be second to none.

Aftermath

While the convention formally closed on Friday night, that was by no means the last of the convention. Saturday a special trip had been planned to Cripple Creek, going over the Cripple Creek Short Line and returning over the Colorado Midland to Colorado Springs. Matters were somewhat complicated by the fact that many of the visitors had extensions of their regular tickets to Colorado Springs from Denver over other roads, while the excursion train ran over the Colorado Southern. Lost, strayed and stolen delegates and guests were discovered in various parts of the different trains, but with the final round-up at the Springs seven carloads of the fragments were collected and started up into the mountains. It is impossible to give an impression by word or photograph of the delight and inspiration of this ride. For 4 hours the train creeps along the edge of the mountains, climbing continually higher, crossing from one side to the other of the canon and doubling back and forth on itself until it reaches the highest level at Bull Hill, in the midst of the gold mining district. The peculiar feature of this region seems to be that although the gold-bearing ore is found in the rock strata, practically all of the producing mines are located on mountains which are covered with turf. The timber covered moun-

W. D. RIGDON, EXEC. COMM. N. E. A.

tains and those of bare rock seem not to have been supplied with any of the precious metal. Evidence of the great rush to Cripple Creek at the time of the opening of that region was everywhere in sight. The mountain sides are jabbed full of holes driven by eager prospectors, which gives the country the appearance of a big town occupied by overgrown prairie dog burrows.

Those of the party who had more enterprise than caution left the train at Victor and made a trip through the Granite mine. They enjoyed the trip and had plenty of time to think about it, waiting 5 hours at Colorado Springs for the train that didn't come. The rest of the delegation, who valued their dinner more than their

HERBERT SELF, EXEC. COMM. N. E. A.

chances for new experiences, went on to Cripple Creek, where they were most hospitably entertained by the Cripple Creek association.

The return trip over the Colorado Midland, while not so rugged as the Short Line, gave a magnificent view of Pike's Peak and of the Pike's Peak Range, and also gave a glimpse of the formation in the Garden of the Gods as the train was passing through Manitou. Many of the delegates stayed over at Colorado Springs and made the Pike's Peak trip. Others returned to Denver and spent Sunday in various trips into the mountains, according as fancy dictated or the runners of the various trips persuaded.

The program had it that Sunday was to be devoted to visiting the Denver churches, but the writer has yet to find anyone who saw the inside of a church at that time. This is no reflection on the morals of the visitors to the convention, but was simply due, as were most other discrepancies of the week, to the "altitude," and to the desire to reach still higher altitudes. It did seem like a reasonable proposition that a train which would carry you up 6,000 ft. would give more of a tangible uplift than any one sermon that was likely to be heard.

It is safe to say that as fast as those who visited Denver on this convention succeed in accumulating ample fortunes, one of the first gratifications indulged in will be a return to the hospitality of Denver and the glories of the Rocky Mountain region to repeat and enjoy the experiences of the week. Nothing was left undone which could be thought of to enhance the comfort and pleasure of the delegates, and although it was the opinion of those from the far east that some process ought to be found for moving the Rocky Mountains up alongside the Mississippi River, still it is a good prediction that if opportunity again offers they will make the trip to the Rockies even where they now stand.

EXHIBIT HALL ATTRACTIONS

HENDRIE & BOLTHOFF is one of the large representatives of eastern industries doing business in the Rocky Mountain region. Several of the firms whose goods are carried by this company had special representatives of their own present, but the exhibits were combined so as to make a harmonious display, on the west side of the hall. A background of palms was used for those displays which were placed in the boxes, relieving the monotony of the cement walls. One box was devoted to specialties, including the power pumps made by the Deming Co., of Salem, O., and steam pumps made by A. S. Cameron Steam Pump Co., of New York City. Smaller specialties included in this space were the Clipper belt laces, the Elliott automatic safety water gage, the valves of the Homestead Valve Mfg. Co., the Wright safety water column, scrapers and packing tools made by the Mound Tool & Scraper Co., air compressors and blowers made by the Blaisdell Air Compressor Co., regulating and reducing valves of the G. M. Davis Regulator Co., and pipe fittings from the Crane Co.

TEN-THOUSAND-POUND-HOSE doesn't stand for the weight of the sample exhibited but for the pressure which it will safely carry of air or water. This was a part of the exhibit of the Peerless Rubber Manufacturing Co. which included rubber goods too numerous to mention in their entirety. Of special interest were the rolls of Rainbow sheet packing and the sample of rubbber conveyor belt which is made by the company up to 90 in. wide and of any length. Rubber tiling, hot-water washout hose, Anaconda engine and tender hose, Peerless duplex hydraulic hose, Success semimetallic diagonal expansion spiral packing with Rainbow core, Rainbow gauge glass rings, Dale's high-pressure automatic steam trap packing in spiral and rings, Honest John hydraulic packing and Eclipse sectional were particularly interesting and noticeable in the complete line of packings and products in the Peerless Co.'s space. The firm was represented by Stephen Roberts and Frank Hardy of New York and by Dan Cubberly and Charles Y. Reed of Denver. As always the booth was a popular one with the delegates who received a fine bound volume of Lives of Prominent Engineers, by Goddard, and with ladies to whom handsome fans were given.

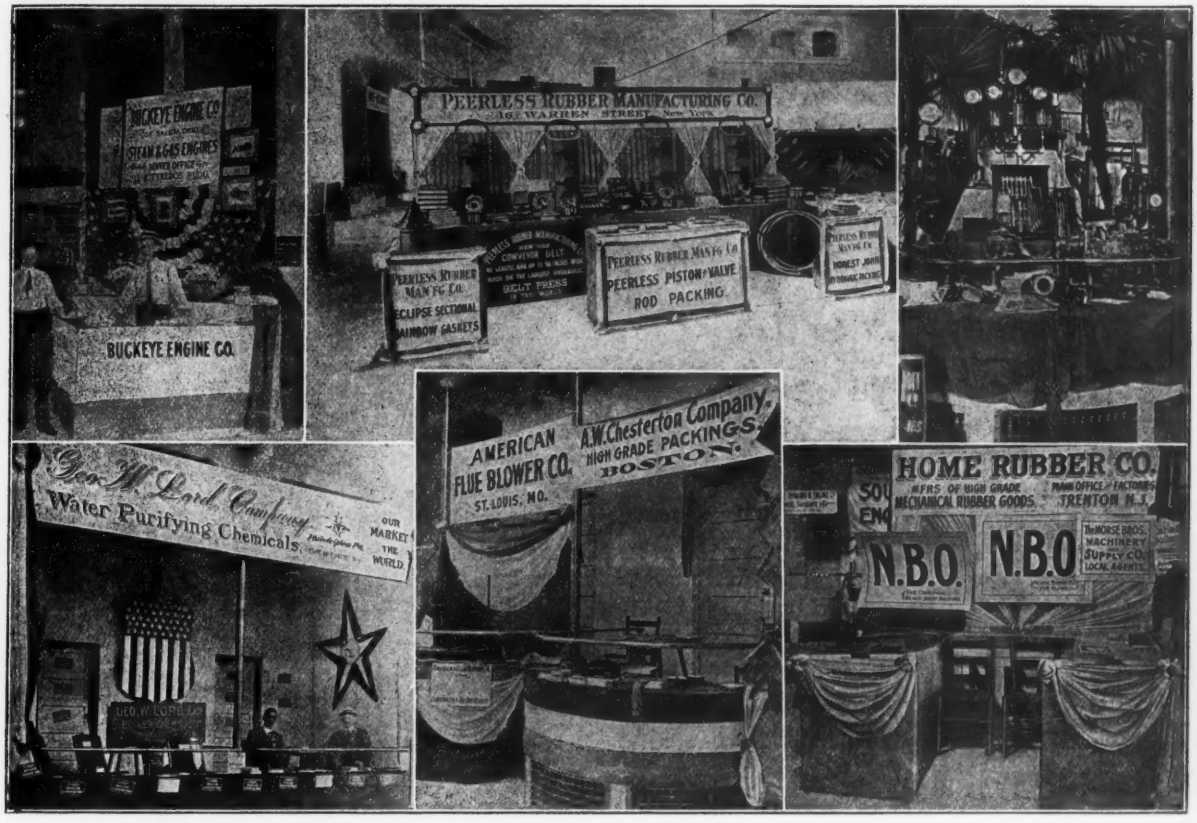
THE BUCKEYE ENGINE CO., of Salem, O., maintained its reputation for doing the right thing in the right way by opening a flower stand in the main entrance and decorating each visitor to the exhibit hall with the flower of his or her choice. In charge of this pleasing duty was C. V. Hunt, of the home office at Salem, assisted by Walter A. Radkey and H. L. Vaughan. The booth

decorations were Old Glory and photographs of Buckeye steam and gas engines.

THE CADMAN STEAM SPECIALTIES, made by A. W. Cadman Mfg. Co., of Pittsburg, and including the indestructible blowoff valve, Aluminum babbitt metal, Cadman Indestructible gage cock and the Champion feedwater heater formed a prominent part of the exhibit. Mr. A. W. Cadman was present looking after these specialties.

In the display were samples of the Chestertons' Diagonal packing, the Rubberbestos spiral, Metal Asbesto, Vaporite, fiber sheet, High-pressure wick and many brands of round and square flax packings for all purposes, the Combination scraper and wire flue brush, and the Ingalls flue scraper.

N. B. O. PACKING was the text and the sermon in the booth of the Home Rubber Co., of Trenton, N. J. Rolls of packing formed the pillars at the entrance,



EXHIBITS OF THE BUCKEYE ENGINE CO., PEERLESS RUBBER MFG. CO., DEMING & CAMERON STEAM PUMPS AND CADMAN SPECIALTIES, GEO. W. LORD CO., A. W. CHESTERTON CO., AMERICAN FLUE BLOWER CO., AND HOME RUBBER CO.

LORD'S BOILER COMPOUND received its friends in 2 boxes at the side of the main entrance. The veteran salesman Edward McCarthy was always there with a glad hand for old and new acquaintances, and was assisted by Albert A Kitto of Pueblo and Oswald L. Keen of Denver. The book on Boiler Scale and Its Formation, many copies of which were carried away by interested engineers, and the mottoes, which were worth while having, were found here. Souvenir key rings and miniature barrels representing those in which Lord's Compound is shipped made the booth popular.

STEAM AND THE Gage Publishing Co. were represented by D. J. McCann and John M. Walton.

IN ONE OF THE SIDE BOXES was shown the full size apparatus made by the American Flue Blower Co. of St. Louis for blowing out boiler tubes, with J. J. McLean in charge.

W. M. REA ARRANGED THE EXHIBIT of the A. W. Chesterton Co. in one of the boxes in the east side of the hall and supplied the visitors with handsome watch fobs showing a roll of the Chesterton sheet packing. sheets of packing the foreground, N. B. O. signs the background and A. R. Foley was master of ceremonies, assisted by H. B. Chandlee. They had neat stick pin flies that would fool even a carnivorous spider into breaking his teeth.

SOUTHERN ENGINEER was represented by J. W. Smith, Robert Larkin, W. S. Cushion and G. Maass.

E. M. SWINDLER looked after the interests of the Arrow Boiler Compound Co. of St. Louis, in one of the side boxes.

THE AMERICAN CORKLID CO., of Denver, showed a new device for the covering of ice cans during the freezing process. These lids were made up of a cork composition, metal bound and coated with an asphaltum so as to be light, to give good insulation and shed water. Otto W. Michelfelder and Geo. L. Vail looked after the exhibit.

ALTHOUGH HAVING NO APPARATUS on exhibition, the Philadelphia Lubricator and Mfg. Co. had for distribution in the box bearing its sign circulars describing the

compound oil and grease cup which the company manufactures.

POWER WAS REPRESENTED by John A. Hill, Fred R. Low, Jack Armour, A. J. Bamford and J. M. Watson.

Metallic brands, and a line of gaskets for pipe flanges. The Vulcabeston air brake pump packing was a special feature. This company was represented by S. M. Hildreth, W. J. Huston and I. P. Trentelaar.

EXHIBITS OF JOHN ROEBLING SONS' CO., THE WESTINGHOUSE CO., GANDY BELTING CO., MURRAY IRON WORKS, HILLS-M'CANNA CO., AMERICAN STEAM GAUGE AND VALVE MFG. CO., N. Y. BELTING & PACKING CO., HENDRIE & BOLTHOFF SUPPLY CO., H. W. JOHNS-MANVILLE CO.

STITCHED COTTON BELTING made by the Gandy Belting Co., of Baltimore, Md., also duck belting and a special dressing for fiber belts were included in the exhibit of that company, which was in charge of C. H. Dankmeyer.

H. W. JOHNS-MANVILLE Co., of New York, occupied one box with samples of its various pipe coverings, including the air cell, Kearsarge, Asbestos, Magnesia and

ABOUT THE CENTER OF THE SPACE occupied by Hendrie & Bolthoff was a 10 by 18-in. Murray-Corliss engine, this size being a special built to give a high grade and economical engine for small powers. On either side of the engine were a Wainwright even flow heater made by the Alberger Condenser Co., of New York City, and a display of drawings of the Lyons water-tube boiler made by the Lyons Boiler Works, of De Pere, Wis. In

this section, besides the catalogs of the heater and boiler, were offered the handsome catalogs of the Murray Iron Works, Burlington, Iowa, and its nomenclature pamphlets which show the name of each part of a Corliss engine.

ON A TRUCK outside the building was shown a large high-speed engine made by the Chuse Engine Co., of Mattoon, Ill.

IN THE INTERESTS OF THE American Steam Gauge & Valve Mfg. Co., of Boston, Mass., W. R. Ladewig, of the Chicago office, was at the convention. The exhibit included an American dead weight gage tester for proving the accuracy of gages, the American Thompson Improved indicator having the new detent motion and equipped with the Ideal redueing wheel, a sectioned model of the American special pop safety valve showing the compound drop lever, the encased spring, the nickel seat and the lock-up mechanism, American combined pressure and recording gauge, and the plain recording gage having the clock movement in the dust-proof casing. A neat little novelty was the Vest Pocket shaft speed counter.

HILLS-MCCANNA Co., of Chicago, makes a specialty of force feed oil pumps, and its display consisted of 1, 3, 5 and 8-feed pumps for various purposes. The company also had an example of its special high-pressure gage cocks, which are made particularly for durability. Messrs. Robert Hills and Thos. A Delaney were in charge.

THE MINING WORLD was represented by Felix Holman.

WEICHMANN TURBINE Cleaners as made by the Weichmann Tube Cleaner Co. were described in pamphlets distributed from one of the boxes.

KENT GREASE MADE in Waukesha, Wis., by the Kent Lubricating Co., was conspicuous by the dark orange color of its booth decorations. Samples of the grease and of cups for using it were shown by L. H. West who also presented a Kent pennant pin to all visitors.

FOUR OF THE WESTINGHOUSE INTERESTS occupied a booth of 4 spaces; these were the Westinghouse Air Brake Co., the Westinghouse Machine Co., the Westinghouse Electric and Manufacturing Co., and the Nernst Lamp Co. The booth was fitted with a table and easy chairs for the comfort of delegates and contained an electrically driven air compressor which furnished power for some other exhibits. There were also electric fans which furnished an electric breeze in which blue "Westinghouse" pennants fluttered under the brilliant light of Nernst lamps. Representing the Air Brake Co. were T. A. Hedendahl and M. H. Burchard; for the Machine Co., N. F. Richardson; for the Electric Co., L. M. Cargo; and for the Lamp Co., R. D. Martin and C. M. Wright.

ONE END OF THE EXHIBIT of Hendrie & Bolthoff was devoted to electrical goods. Included in this was a pyramid of insulators made by the Locke Insulator Co., coils of weather-proof and fire-proof insulated wire made by John A. Roebling's Sons Co., a motor from the Wagner Eletcric Mfg. Co., a generator made by the Fort Wayne Electric Works, an electric kitchen which is made from standard apparatus and arranged specially by the Hendrie & Bolthoff Co., Kuhlman transformers, an Emerson direct-current motor driving a Buffalo Forge Co.'s blower, General Electric fans, a switchboard showing Fort Wayne and Wagner meters and a standard line of switches. At the end of the exhibit was a display of the H. T. Paiste porcelain material, consisting of sockets, cutouts, rosettes, switches, etc. The company also carries the H. W. Johns-Manville No.-Ark fuses, the Colorado mine signal system, the Bolthoff hoist and the Bolthoff mine level indicator. Besides the special representatives of the various companies there were present in the interests of Hendrie & Bolthoff, Charles Davidson, H. H. Kaylor and W. A. Roper.

ANOTHER BOX IN THIS ROW of exhibits was devoted to the product of the John A. Roebling's Sons Co. The front of the box was ornamented with coils of wire rope and the edge of the box lined with a series of clips for fastening the ends of rope. A sample board showed some of the different styles and sizes of rope made by the company. Albert L. Seaman, of Philadelphia, J. McG. King, of Denver, and J. H. Wilson, Chicago, were in charge of this box.

THE EXHIBIT OF THE New York Belting & Packing Co. was in charge of Thomas H. Dickinson, and consisted of a fine display of rubber belting, sheet packing and steam and hydraulic hose, both plain and armored.

THE RIDGWAY DYNAMO & ENGINE Co. is represented in Denver by Lindrooth, Shubart & Co., and distributed from its box copies of Bulletin No. 18, showing views of the plant at Ridgway, Pa., and of various power plants where the Ridgway dynamos and engines are installed.

REPRESENTING THE National Engineer at the convention were Sidney Hamilton and John Lane.

BURNITE-LEONARD ENGINEERING Co., of Denver, is engaged in design of plants and selling of specialties. A blueprint of a large plant formed the background for the exhibit, which included the Hardscrog air drill and an improved form of miner's candlestick. The company also handles engines and boilers made by the Erie City Iron Works, Erie, Pa., and air compressors made by the Bury Air Compressor Co. J. B. Burnite and Frank Leonard compose the firm.

COLUMBUS, O., went right after the 1909 convention as if it meant to win. Its partisans had a box in the exhibit hall which was decorated with photographs of the conveniences and attractions to be found in that city, and with pennants. Booklets describing the city, lapel buttons and stick pins were additional arguments used to win favor.

IT WAS THE INTENTION of the F. S. Walton Co., of Philadelphia, to have an exhibit of Ox-Oil-Ox belt dressing in charge of P. F. Reilly, vice president of the company, and James McDevitt, but a fire which destroyed one of the buildings on Aug. 15 made this impossible, and a sign bearing the name of the company was the only matter in evidence. This was unfortunate, as the Walton Co., being the largest distributor of Neat's foot oil, would certainly have had an interesting exhibit.

CONCRETE CEMENT AND PLASTER Co., of Denver, had arranged an attractive showing of what can be done with Bulldog plaster, consisting of heads, statuettes and medallions, in charge of L. M. Pfeiffer.

ONE OF THE ENTERPRISING DENVER firms which contributed much to the success of the exhibit was the Morse Brothers Machinery and Supply Co. This firm had 10 spaces devoted to as many different firms and specialties which it represents and supplies to Colorado trade. These were an air compressor, pneumatic hammers and drill of the Chicago Pneumatic Tool Co., centrifugal pumps, belt, engine and motor driven, 1 and 2 stage vertical and horizontal shaft types of the American Well Works, Aurora, Ill.; a line of triplex power pumps for belt driving and with single gear reduction of the Gould Manufacturing Co., Seneca Falls, N. Y.; a line of single cylinder pumps of the National Steam Pump Co., Upper Sandusky, O.; belted fans and blowers of the Garden

City Fan Co., Chicago; files and scrapers made by Henry Disston & Sons File Co. of Philadelphia; pipe dies, stocks and cutters of the Reed Manufacturing Co., Erie, Pa.; Cross oil filters made by the Burt Manufacturing Co. of Akron, O.; a line of split wood pulleys from the Reeves Pulley Co., Columbus, Ind.; a fine line of the White Star valves, lubricators and other brass specialties of the Wm. Powell Co., Cincinnati, O.; forges, hand blowers and drills of the Canedy-Otto Manufacturing Co., Chicago Heights, Ill.; a full line of the U. S. Automatic injectors made by the American Injector Co. of Detroit, Mich. Both B. P. Morse and George G. Morse were active about the convention and several representatives of the various firms included in the exhibit were also at their respective booths.

FOR THE GEO. M. DAVIS REGULATOR CO. of Chicago, J. C. Kinsley and M. D. Neely were in attendance, and gave each delegate a handy combination paper weight and looking glass. The large line of regulating, reducing and automatic valves made by this concern was well illustrated in the exhibit. Of special interest was a sectioned sample showing the construction of the extra heavy automatic stop and check valve recently perfected by this company.

BOOTHS OF QUAKER CITY RUBBER CO., G. M. DAVIS REGULATOR CO., GENERAL ELECTRIC CO., D. T. WILLIAMS VALVE CO., PHILIP CAREY CO., ALLIS-CHALMERS CO., GOULDS MFG. CO., DEARBORN DRUG AND CHEMICAL WORKS, AMERICAN INJECTOR CO., DETROIT LUBRICATOR CO., MORSE BROS. MFG. CO., M'LEOD & HENRY CO.

USE AND COMFORT were exemplified in the space used by the General Electric Co. A 35-kw. horizontal Curtis

turbo-generator unit with examples of blading and nozzles was the largest piece; but the ladies were interested in the electric kitchen fitted with oven, flatiron, coffee urn, teakettle, griddle, boiler and other utensils, the use for which male persons know not of. The booth was lighted by tungsten lamps in Holophane shades, a specially pretty effect being secured by the use of a ground glass bulb and ground glass shade. A cluster for overhead store lighting was arranged with a three throw snap switch so that three intensities of lighting could be obtained. W. W. Terrence, of the Denver office, was in charge of the exhibit.

DISPLAY OF THE NIXON-LANCASTER ENG'G CO., GARLOCK PACKING CO., CRANE CO., FRANCE PACKING CO., ONDERDONK ENG'G. CO., LAGONDA MFG. CO., U. S. GRAPHITE CO., LIBERTY MFG. CO., KEYSTONE LUBRICATING CO., ATLAS PRESERVATIVE CO., BRITISH-AMERICAN CHEMICAL CO., CANCOS MFG. CO., HAWKEYE COMPOUND CO.

THE COMBINED BOOTHS of the Quaker City Rubber Co. and the D. T. Williams Valve Co., served also as headquarters for the National Exhibitors Association. W. D. Purcell of the Quaker City was secretary of the association and C. K. Thomas of the D. T. Williams Co. was acting president of the association. As an exhibit the Quaker City Co. had a line of rubber goods including Ebonite sheet packing, Daniels P. P. P. rod packing, Hercules sheet packing, steam and hydraulic hose and Ironside rubber belt, which by a special process is made of rubber on a 32-oz. duck and with friction surfaces giving increased grip on the pulleys, and is also much firmer requiring a pull of 26 lb. per inch to separate the plies as against 16 lb. for ordinary rubber belt. Besides Mr. Purcell, G. W. Stolle was present for the company. A pocket steel scale was the souvenir.

MAGNESIA AND ASBESTOS PRODUCTS were the basis of the display of the Philip Carey Co. of Lockland, O. Magnesia and asbestos air cell pipe covering; asbestos paper and board, asbestos rope, special moulded covering for

valves and fittings and a method of covering boilers by the use of asbestos and wire cloth were shown. E. H. Mueller and J. H. Thompson furnished the explanations.

THE ALLIS-CHALMERS CO.'s works at West Allis, Wis., were shown in a big photo forming the background of the booth. The decoration was a handsome pattern in Nile green and white. A full line of the company's bulletins was distributed by C. W. Bucklew, of the Denver office. R. B. McConney, of the Denver office, and R. D. Tomlinson, chief operating engineer, were also present.

DEARBORN DRUG AND CHEMICAL CO., as usual, provided a resting place for weary visitors in its space, which was fitted up with palms and oriental rugs. It was popular, too, for the good cheer of its hosts and because of the caliper scales which went to the men and the bottles of sweet savor for the ladies. James G. Beckerleg was doing his 27th annual convention, while Dan Delaney and G. W. Spear were by no means novices. E. T. Ward, D. E. Cain and V. R. Hughes were also in evidence.

D. T. WILLIAMS CO. showed a line of brass specialties including valves, cocks, oil and grease cups, and samples of its line of steam traps.

ALTHOUGH REPRESENTED IN THE Denver territory by Morse Bros. Machinery & Supply Co., the American Injector Co., of Detroit, sent a special representative to look after its interests. Mr. Trix brought with him a fine line of brass goods, the special features being sectioned full size models of the U. S. injector and the U S. inspirator. A background for these was provided by a display of oil cups, grease cups, cocks and valves.

AN EXCELLENT LINE OF cylinder lubricators, multiple oil feeds, oil cups, hand oil pumps, check and quick acting valves was mounted on an iron frame to form the display of the Detroit Lubricator Co., Detroit, Mich. The representatives were A. D. Howard, C. C. Bagnall and E J. Campen.

JOHN H. FOOTE OF NEW YORK CITY, welcomed his many old friends at the booth of the McLeod and Henry Co., of Troy, N. Y. Examples of the "Steel Mixture" boiler setting blocks and a model of a boiler furnace made from the blocks formed the exhibit. A. H. Schoenbeck assisted Mr. Foote in supplying delegates with descriptive catalogs, watch fobs, caps and buttons.

A NOVEL MACHINE was the Geo. L. Vail Simplicity double can ice machine, exhibited by the Nixon-Lancaster Engineering Co., of Denver. Besides this there were the McDaniel steam traps made by the Watson McDaniel Co., the Richardson sight-feed oil pump made by the Sight Feed Oil Pump Co., of Milwaukee, which was shown in operation; Swartwout separators and exhaust heads, by the Ohio Blower Co., Cleveland, O. The Nixon-Lancaster Co. also handles the Erieco engine and Riblet feed-water heaters, made by the Erie Mfg. and Supply Co., of Erie, Pa.; and Magic Compound, made by John Callahan & Co., of Chicago. A handsome feature of this exhibit was the floral display, frozen into a cake of ice; the design was changed each day. W. S. Nixon and E. H. Lancaster represented the company, and W. E. Richardson was also at the exhibit in the interest of the Sight Feed Oil Pump Co. Tudor boilers, Williams traps and safety water columns and Brunswick refrigerating machinery are also handled by the Nixon-Lancaster Co.

PACKINGS OF ALL KINDS, and all bearing the familiar "rule and calipers" trade mark, were found displayed by the Garlock Packing Co. All cannot be mentioned, but among them were Duo square flax and spiral, shredded metal, Derby round, high-pressure diagonal, Alabastine sectional, Majestic gum core, Star diagonal, hot water, hydraulic special, Duo with braided metal cover, flexible metallic, ammonia metallic, Garlock high-pressure sheet and gaskets, and metal insertion tubular. Special attention was called to the No. 900 sheet packing, which is a tough, fibrous material for oil, acid, water or steam lines, especially for superheated steam. Steam and water hose, both plain and armored, were also shown. In the booth were found J. T. Potts, C. A. Barnhart, C. V. Patterson, T. W. Wilts, M. H. Mickey, J. A. Stuart and E. G. Lapham. Nail files were the souvenirs.

CRANE CO.'S EXHIBIT was a line of brass valves and unions, all iron, or half brass and half iron, samples of cast steel valves and fittings, ammonia valves and fittings, Crane lap flanges in which the end of the pipe is turned over and trued up so that the joint is formed between the ends of the two pieces of pipe, the flanges serving to take the pull of the bolts. Samples of Klingerit packing were also shown by the representative, F. W. Knapp.

A. W. FRANCE made the convention a part of a trip to the Pacific coast. In the double space exhibit of his company, the France Packing Co. of Philadelphia, Pa., were displayed metallic packing rings with cages for stationary and locomotive work, round and square flax packings, and special ammonia packings. Each visitor was given a combination pen and pencil with which to write his name on the register. W. C. Cowling assisted Mr. France with the exhibit.

MANY FAMILIAR NAMES of eastern firms were found in the spaces of the western companies. The Onderdonk Engineering Co., of Denver, had in charge the interests of the Babcock and Wilcox Co., including the B. & W., Stirling and Cahill water-tube boilers; those of the Foster Engineering Co., which makes the Foster pump governors, the Foster reducing valves, the Foster float valves and other specialties. Samples of the Foster goods were on exhibition and the B. & W. boiler was illustrated by a sectional model of boiler and setting. Copies of the books, "Steam" and "Stirling," which are valuable engineering reference books, as well as descrir tions of boilers, were distributed at the booth.

The Onderdonk Co. also handles the Lagonda Manufacturing Co.'s goods for the Colorado territory, Filer and Stowell Corliss engines, Chandler & Taylor high-speed engines, Reeves high-speed engines, Wheeler pumps and condensers, Goubert feed-water heaters, Green economizers, Keasby & Mattison pipe coverings, and Burt oil filters and exhaust heads.

ALWAYS ON THE GO applies to everything which bears the name Lagonda or Weinland, whether it be tube cleaners, representatives or an exhibit. In this exhibit the cleaner heads kept pace with the motto and were always turning. Besides the frame with the cleaner head border there were in the space of the Lagonda Manufacturing Co. a big automatic stop valve, sectioned to show its action, Weinland reseating machines for the caps of water-tube boilers, Weinland power tube cleaners, Weinland turbine cleaners and heads. The special features which were new and attracted particular attention were the front thrust bearing cleaner and the steel wing heads with parallel action which are now used on all Weinland cleaners. Henry Weinland, M. M. Sellers and J. P. Malloy kept things lively in the big Lagonda space and sowed seeds of friendship in the form of key tags.

MEXICAN GRAPHITE, although it is made by the United States Graphite Co. in Saginaw, Mich. is mined

in Mexico, samples as it comes from the mine showing an exceptional purity, free from grit and ready for immediate grinding to an impalpable powder. Several samples were shown in a booth which was handsomely set off by fresh flowers and backed by a pyramid skillfully arranged with cans of the Mexican Graphite. The

Liberty twin strainer, the Liberty-Greenaway separators, and the Liberty feed-water regulator and safety water column. There were present for the company, C. J. Carle, vice president, and Messrs. C. A. Conn and W. H. Hill.

CHARLIE HOPPER AND KEYSTONE GREASE are one and

EXHIBITS OF JAMES M'CREA & CO., MICHIGAN LUBRICATOR CO., ASHTON VALVE CO., CLING SURFACE CO., GREENE, TWEED & CO., A. LESCHEN SONS ROPE CO., AMERICAN STEEL & WIRE CO., JOSEPH T. RYERSON & SON, ADAM COOK'S SONS, THE WM. POWELL CO., PILLEY PACKING & FLUE BRUSH MFG. CO., UNDERFEED STOKER CO., INTERNATIONAL CORRESPONDENCE SCHOOLS, THE STRONG, CARLISLE AND HAMMOND CO.

flowers and souvenir pencils were presented to the ladies and delegates by W. F. O'Hara.

LIBERTY MANUFACTURING CO. "turned the bull loose" frequently when the Liberty turbine tube cleaner began operating by compressed air. It was a good demonstration too. Besides this cleaner, which was shown in all sizes and with many different styles of heads for steam as well as air, there were the Faber blowoff valve, which "washes its face," the Liberty oil purifier, the

inseparable, in fact, Hopper and Urquhart were known as "two slippery kids." Anyway they, with Herbert Self and J. H. Campbell, kept things lively at the Keystone Lubricating Co.'s quarters and capped everybody in sight. Souvenir day brought post cards and coin purses which were greatly appreciated by the recipients. A novelty in the booth was a working model of an engine and shafting showing the application of grease by means of cups to shafting, engine bearings, pins, etc.

"BRISAM" BOILER COMPOUND made at Patterson, N. J. by the British-American Chemical Co. had its pamphlets for distribution describing the advantages of its product. The company was represented by Frederick W. Johnson.

ATLAS PRESERVATIVES are made for various classes of iron and steel structures by the Atlas Preservative Co. of Belleville, N. J. Class E. for boilers is described in a special pamphlet which was distributed by Jacob C. Ludwig.

THE SAILOR MAN is always popular even on the plains, and a noble fleet is a goodly sight; the Black Squadron with which Cancos Manufacturing Co. decorated its quarters was worthy of its name. It was for steam and hydraulic use, in wedge and tubular form and the fleet was rigged with asbestos rope valve packing. Cancos metal polish kept the guns bright. Engineers memorandum books were given out by the company's representative, Harry Harmstad.

CIRCULARS DESCRIBING THE Hawkeye Compound in bricks were distributed with Hawkeye buttons from the booth of the Hawkeye Compound Co. by H. E. Tibbles and W. F. Ebert of Chicago, J. E. Allen of Colorado Springs, and Glen Deyo of Omaha.

IN ALL LUBRICATORS AND CUPS made by the Michigan Lubricator Co. is used the automatic ball drain valve invented and patented by W. E. Bryant, vice president and manager of sales, who represented the company at the convention. This ball is weighted so that it always floats right side up and is regulated to float in water and sink in oil; it, therefore, stands between the oil and water and when the drain cock is opened allows the water to escape, but shuts off when the oil tries to run through. Miniature monkey wrenches were the souvenirs.

ASHTON POP SAFETY VALVES, whistles, gages and indicators were attractively displayed in the space of the Ashton Valve Co., which is represented in Denver by the Hampson-Fielding Co. "Clum" Dill was on hand, as young as ever. An interesting novelty was the alarm steam gage, which rang a bell on a variation of pressure 10 lb. above or below the pressure for which it was set. J. M. Robbins was in the booth, and supplied visitors with pocket pencils. In this booth were also circulars of the pipe threading machine made by the Threading Machine Co., of Sandusky, O.

CLING-SURFACE, which fits a belt to hang to a pulley without putting on tension to grind out the bearings, and which is made by The Cling-Surface Co., of Buffalo, N. Y., was shown in sample cans, and the effect of its application demonstrated on a model of shafting and pulleys which showed the pulling power of a treated belt under practically no standing tension as compared to that of a tight belt which has been treated. Dr. W. D. Young, of the Cling-Surface Co., was in charge.

SELF-LUBRICATING packings in the Palmetto round and square forms and as twist on the spool, also the Favorite reversible ratchet wrench were the features of the booth of Greene Tweed & Co., of New York City. Boxes of the packings were formed into a pyramid which was surrounded by comfortable chairs whose occupants were kept "chirping" for Palmetto with the "green bug." F. E. Ransley and B. M. Bulkley were on duty. The Palmetto goods are also carried by Hendrie & Bolthoff.

SAMPLE BOARDS OF WIRE ROPE in all sizes and a central pyramid of reels of wire rope of various sizes, with 2 big reels standing on edge, filled the space of the American Steel and Wire Co. At the top of the pyramid was an electric sign in red, white and blue lamps, showing the initials of the company name. A. T. Merriman and G. H. Williams were in attendance at the convention.

HERCULES WIRE ROPE with round and with flat strands was shown by A. Leschen & Sons, of St. Louis, on 2 full-size reels. Keystone safety shackle hook, and the Atlas clip for holding rope ends were also shown by this company. C. E. Pester and H. R. Wadeson were in charge.

HEAT LOSSES DUE TO BRICK BOILER SETTINGS and how they can be overcome was the title of a booklet describing the Continental boiler, which was presented by Joseph T. Ryerson & Son at their booth. In addition, a book on Continental Boilers, and the August issue of Ryerson's Monthly Journal were distributed. A glazed working model of the boiler was shown, and samples of Glyco Metal, which is a cheaper substitute for tin and bronze alloys, with better qualities. A paper weight, presented by J. T. Corbett, was this firm's remembrance to delegates.

ADAM COOK'S SONS make Albany Grease, and they also made a fine showing with it. Light yellow and black are the firm's colors, used on all labels and in decoration with a sun-ray effect. The trade mark, the man on a plank and the motto O—EZR—IC were conspicuous on the sign. Sample boxes of the grease and examples of the various cups used for feeding were part of the exhibit. Silas Cook represented the firm and furnished convenient pocket pencils.

WM. POWELL CO. of Cincinnati had on display a full line of White Star globe valves,Titan quick opening valves and other specialties. Fine fobs with an embossed valve on a shield were distributed by Vice President Charles E. McFarland and R. S. Rowe. The booth was arranged with notable taste and care.

FLUE BRUSHES, FLUE CLEANERS, wire brushes for all uses, scrapers, and packing tools in artistic arrangement, formed the background for an unique display of the Pilley Packing and Flue Brush Manufacturing Co., of St. Louis. On the table below were samples of a complete line of packings, including Black Bestos rod and sheet packing, moulded and sectional rings, round high-speed, in moulded rings and spiral, sectional spiral, expansion wedge, various forms of flax and duck, asbestos sheet and wick tubular and flat gasket. The president of the company, L. B. Shultz, and M. E. Briggs, the western representative, presented each delegate with a souvenir watch fob.

JONES UNDERFEED STOKERS are rather too large for exhibit in a space only 6 by 8 ft. so that the Underfeed Stoker Co. of America which is represented in Denver by Gilbert Wilkes & Co., could explain what the Jones Stoker is and does only by means of its literature; but that was done thoroughly and entertainingly by the representatives C. H. Thomas and R. J. Thomas.

"AMBITION" IS THE NAME of the journal published by the International Correspondence Schools to arouse men to what they can do for themselves. Copies of this and of the schools' catalogs were freely furnished at the exhibit and the value of the lessons illustrated from the Library of Home Study and Reference, which was attractively displayed in sectional bookcases. J. D. Jones, H. B. James, G. E. Quinlisk, W. S. Broderick and O. J. Baum were kept busy with inquiries.

MANY HAVE CONJECTURED what the magic 4/S sign of the Strong, Carlisle and Hammond Co., of Cleveland, O., might mean. Those who inquired at the exhibit found out. In the space of this company were the

Squires feed-water controller, the Squires high-pressure steam traps, the Squires pump governor and the Squires reducing valve; also the newest specialty, the Winters vacuum trap. All these were well explained by Homer Whelpley.

In its Reilly Multicoil heater and its Reilly multicoil evaporator, the Griscom-Spencer Co., of New York City, embodies a coil for the transmission of heat, and a spring to take care of expansion. The how and why of this was clearly illustrated in the sectioned apparatus which was exhibited. Besides these 2 the Reilly grease extractor was shown. J. B. Spencer, of New York, was at the convention and afterward completed a trip to the coast.

Jenkins Brothers fitted up an attractive, palm-decorated parlor near the center of the hall for the comfort of the delegates and their wives. In it were found a handsome hall clock and easy chairs for the tired visitor, while to occupy his time while he rested was a display of Jenkins valve disks, '96 packing, Jenkins globe valves, Jenkins tubular gasket, and flat gasket. The engineers were welcomed by Messrs. C. J. Jackson, W. G. LeCompte, Frank Martin, W. J. Brown and William Murray.

CRANDALL PACKING CO., JENKINS BROS., GRISCOM SPENCER CO., MONARCH STEAM BLOWER CO., CHAPMAN VALVE MFG. CO., MASON REGULATOR CO., STEARNS-ROGER MFG. CO., THE LUNKENHEIMER CO., H. H. FIELDING, AUSTIN SEPARATOR & WRIGHT MFG. CO., REVERE RUBBER CO.

Crandall Packing Co.'s special line of goods was very complete. Besides the usual square flax, hydraulic and spiral, there was Rex Gum Core, Helios Twist, Plastic Asbestos metallic, Crandall diagonal, Crandall

Red Tubular with lead insertion and with asbestos insertion. B. M. Knobel, H. Crowder and J. J. Reddy were the representatives.

FROM THE NAME OF THE Mason Regulator Co. one would expect to find in its space a line of regulating apparatus; and was not disappointed. A damper regulator, pump regulators, pressure regulators; also balanced valves and pressure reducing valves were displayed in large sizes, sectioned so that the working could be easily seen and understood. A neat leather bag tag was given to each visitor. The familiar features of Frank Morrison were seen in this booth and Elton McLeod, who is a newcomer among exhibitors, was with him.

CHAPMAN VALVES OF ALL KINDS and descriptions were crowded into the booth where Herbert Stone loomed up as representative of the Chapman Valve Mfg. Co., Indian Orchard, Mass. Anybody who didn't know Stone before probably does now. One of the most interesting features of the exhibit was a big electrically operated valve for distant control, used especially for shutting off steam in inaccessible positions and as safety device in case of breakage of steam pipe. Besides Mr. Stone the company was represented by W. L. Buss, of the Chicago office, and the goods are carried in the western territory by Hendrie & Bolthoff.

MONARCH FLUE BLOWERS and Monarch draft blowers, made by the Monarch Steam Blower Co. of Troy, N. Y., were shown in full size by the Denver Engineering Specialty Co. with J. Frank Lanning of Pittsburgh and G. R. Sanford of Denver in charge. The quick and effective action of these blowers was apparent from the clear explanations given. The Sterling metallic rod packing for steam and ammonia was also shown, consisting of wedging rings of soft metal backed in the stuffing box by rings of soft packing.

HEATING AND VENTILATION are branches of engineering which are made a specialty of by Howard H. Fielding of Denver. The best display of his skill was the system in the Auditorium which is equipped with the same apparatus as displayed in the exhibit. This included an open feed-water heater made by Warren Webster & Co., of Camden, N. J., and a line of its other special apparatus, expansion joints, oil and steam separators, dirt traps for heating systems and motor valves for controlling steam in the radiators.

The Western Kieley Specialty Co.'s apparatus, also shown here, consisted of traps, reducing and float valves, and other devices for controlling steam pressure and draining steam piping.

IN A BOOTH decorated with orange and yellow, samples of the brass goods made by The Lunkenheimer Co. were tastefully arranged. Oil cups, force-feed lubricators, injectors, renewable seat valves, whistles, etc., though numerous, gave but an inadequate idea of the real extent and variety of the line made by this company. B. T. Delafield was in charge of the exhibit. Lunkenheimer generator valves for auto-boats and automobiles were made a prominent feature.

HEINE WATER-TUBE BOILERS made by the Heine Safety Boiler Co. of St. Louis, Gardner governors and steam pumps from the Gardner Governor Co. of Quincy, Ill., Williams feed-water regulators and alarm water columns made in Pittsburgh by the Williams Co., Green traveling link grates from the Green Engineering Co. of Chicago, Ideal Engines made by A. L. Ide & Sons Co. of Springfield, Ill., and Ingersoll-Sergeant rock drills are handled in the Denver territory by the Stearns-Roger Manufacturing Co. of Denver. The exhibits were located in a booth handsomely decorated in blue and white which occupied 3 spaces. Henry L. Wilson, A. B. Kennedy and J. A. Freeman did the honors for the company with souvenir memorandum books as reminders.

SEVERAL FEATURES in the booth of the Revere Rubber Co. were worthy of and received the careful attention of visitors. A new form of hose was shown which is made up by double braiding a thread sheath over a seamless rubber tube, covering this sheath with a layer of rubber; then braiding on another sheath and so on as may be necessary for the purpose. In vulcanizing, under pressure the rubber is forced into the fabric, coating it and waterproofing it. This gives a hose that is seamless, can not kink, will not strip and can be made in any length up to 500 ft. There was also a full line of packings and mechanical rubber goods including Black Hawk, Samson, Usudurian, Hi-Heat, Revere and valve rope. Walter D. Rigdon, S. F. Denny and W. J. Spencer represented the company whose souvenirs were coin purses and pencils.

BESIDES SECTIONED SAMPLES of the Wright Safety water column, of the Wright Emergency steam trap and the Victor low-pressure trap, the Wright Manufacturing Co., of Detroit, Mich., showed separately the triple valve which gives the Wright trap its large opening and illustrated by an interesting lot of sectional views on the back wall of the booth the Wright exhaust head and other apparatus which the company manufactures. These drawings were so clear that they showed the action of the apparatus quite as well as the actual machines would have done. In the same booth, the Austin Separator Co., which is allied with the Wright Co., showed the action of the Austin line of steam, oil and vacuum separators in the same way. H. H. Humphrey, representing both companies, presented his guests with a perpetual souvenir calendar.

STEAM PIPE LEAKS are a nuisance, and are often difficult of immediate repair. A device which will stop them at once and effectively is really a friend in need; hence, the Model Flange clamp and the Climax Steam Joint clamp which were shown in place on a pipe section by James McCrea & Co. aroused great interest. The H. H. steam trap, Butman jointed flue rod, Wernicke boiler tube cutter, Century drilling machine, Century gasket cutter and Perfect valve disc were also in this collection of useful devices. M. B. Skinner, vice president of the firm and L. W. Naylor were at the booth and presented delegates with a lizard desk weight.

OIL AND GREASE CUPS are one of the most necessary appurtenances of machinery in a plant, hence the pamphlet on Williams oil and grease cups is of vital interest. It covers snap lever cups, slide lever cups, pressure cups, automatic rod oil cups, automatic grease cups, screw feed grease cups, and plain compression cups. In this pamphlet, which is issued by the D. T. Williams Valve Co., of Cincinnati, Ohio, will be found a cup for every situation on engine or machinery bearings. A copy can be had for the asking.

IN BULLETIN No. 4610 of the General Electric Co., is described a new line of continuous current switchboards for small plants. These boards are equipped with the latest and the most improved controlling devices, for 125 and 250-volt circuits only. Each panel forms a separate and complete switchboard, made to control 1 generator and 2 feeder circuits and is not intended for combination with other panels. The panels are of black slate, supported by 1-in. gas pipe, and are fully described in the bulletin.

NEW STURTEVANT ELECTRIC MOTOR

For successfully driving centrifugal fans a motor must have characteristics which are, of course, best known to the makers of these fans. The B. F. Sturtevant Co., pioneers in the manufacture of fans and blowers, have been uniformly successful in making economical and satisfactory fan sets. Not only are the fans efficient, but the motors, engines, and turbines also, are efficient.

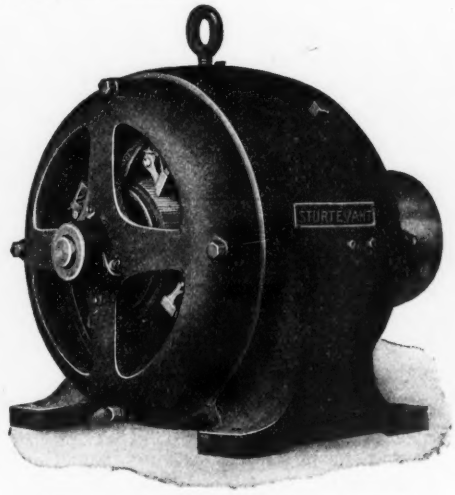


FIG. 1. TYPE H STURTEVANT MOTOR

In the Sturtevant electric fans, consisting of steel-plate fans and Sturtevant direct-connected motors, the motors are designed for fan driving, especially the new Type H motor which is being placed upon the market. This 4-pole type will carry a 50 per cent overload for 1 hour without destructive sparking or heating, and will carry 100 per cent overload for 5 min. The armature has been especially designed for ventilation in order that the heat rise might remain low for all conditions of service, and the motors themselves have a very conservative rating. These characteristics show these motors to be especially adapted to fan driving, for electric ventilating fans may be accidently overloaded, and are too often cared for by unskilled labor. Built in a complete line from 1 to 100-hp., and enclosed, semienclosed and open, they meet all requirements of up-to-date installation.

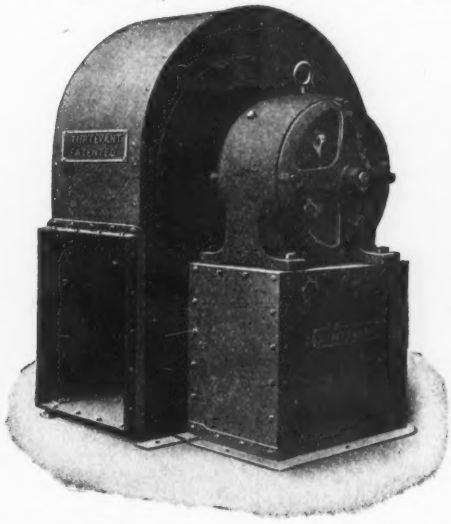


FIG. 3. DIRECT-CONNECTED FAN AND MOTOR UNIT

The magnet frame, which is of cast iron, is machined for the pole pieces and bearing brackets which are bolted to each end of the frame by 4 bolts, spaced equally so that the motor may be bolted to the floor, wall or ceiling by simply shifting the bearing bracket and without additional machine work.

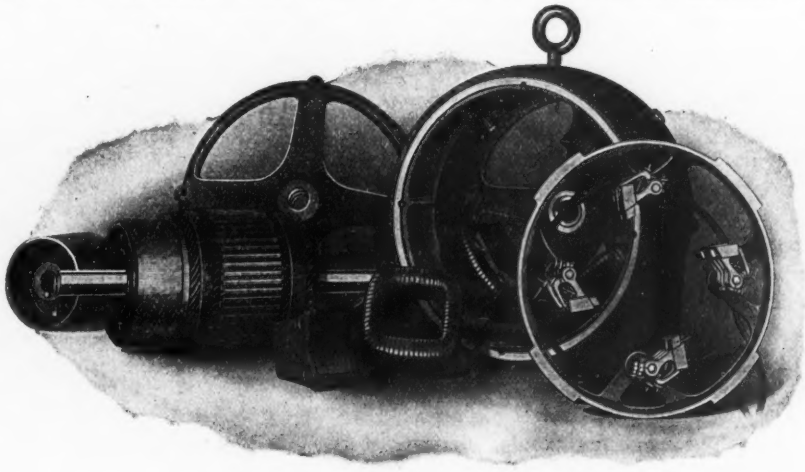


FIG. 2. PART OF STURTEVANT MOTOR

The pole pieces are built up of soft steel punchings, riveted together between end plates while under pressure. The punchings are so formed as to provide a support for the field coil and so to distribute the magnetic flux as to produce sparkless commutation under wide variations of load. The pole pieces are bolted to the frame by hexagon head tap bolts which

pass through the frame and are threaded directly into the pole piece. By removing these bolts a pole piece with its field coil may be removed without removing the armature or dismantling the motor.

The field coils are machine wound of double cotton covered copper wire of highest conductivity, and are carefully insulated and held together by 2 layers of heavy tape. The coils are thoroughly insulated and protected in the most approved manner, both against moisture and mechanical injury.

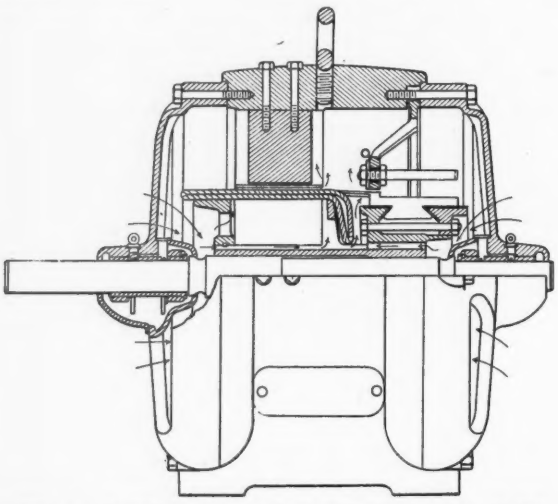


FIG. 4. PATH OF AIR THROUGH VENTILATING SLOTS

The armature is of the iron-clad slotted drum type, built up of soft annealed sheet steel punchings insulated from each other by a coating of japan. These laminations are assembled on a cast-iron sleeve, which is provided with openings for free circulation of air, and has an extended hub for the reception of the commutator shell, making the armature and commutator one self contained member.

The shaft is of the best quality of hammered steel, accurately ground to size, and is of sufficient size and strength to resist all appreciable bending under any conditions of overload.

The commutator is built up of bars of hard drawn copper, securely held in a cast iron shell of spider construction. The insulation between the segments is of the best quality of carefully selected amber mica of such a degree of hardness that the mica and copper segments will wear uniformly, thus obviating any trouble from high mica. The insulating bands, which insulate the segments from the clamping rings, consist of mica of the best quality, and the whole commutator is assembled, while hot, under great pressure, so that every bar is firmly held in place and cannot work loose in service. The commutator bars are provided with risers, into which the leads from the armature coils are soldered, thus permitting the connection of the leads with little bending and small liability of trouble from short circuits at the back end of the commutator.

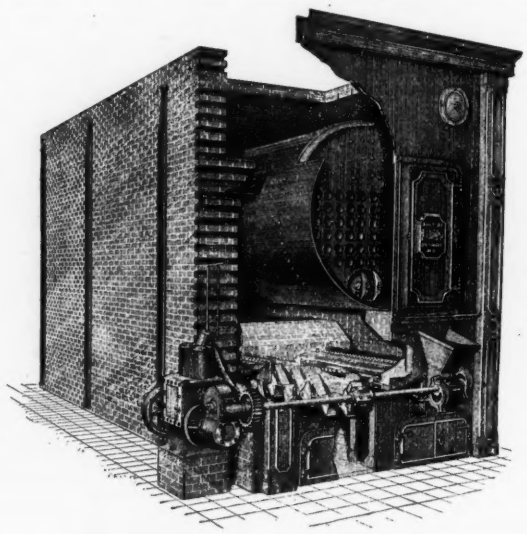
The brush holders are supported by a ring of spider construction which is, in turn, supported in a machined recess in the magnet frame, being clamped into position by the front bearing bracket. The brush rigging is thus firmly held in position, and while it may be easily shifted, there is small liability of the brushes being thrown out of position or tilted, as is the case when the brush rigging is clamped by set screws. The brushes are of high grade carbon, selected for high conductivity, sparkless operation and long life, each brush being provided with a braided copper cable shunt or pig-tail, thus relieving the brush holder body and springs from carrying any current.

These motors are built by the B. F. Sturtevant Co., Hyde Park, Mass.

THE LUCKETT STOKER

This stoker shown in the cut is simple in construction and operation. In the furnace there are 2 magazines, so placed that each 1 will take care of 0.5 of the width of the furnace. On the sides of these magazines are the grates, which incline toward the center and sides of the furnace. At the front end of each magazine is a hopper into which the coal is fed, either by the fireman or by chutes leading from the bottom of the coal bins overhead.

After the coal is in the hoppers, it is carried into the furnace by what are termed conveyors, their number depending on the depth of the furnace. These conveyors oscillate about a shaft and work alternately, that is, while 1 is moving up the other is moving down. By this action the coal drops in front of the conveyors.



LUCKETT STOKER IN PERSPECTIVE

The first pushes it back under the dead plate, and as it reaches its extreme forward position, the second conveyor has reached its extreme lower position and takes the coal that has been moved forward by the

first conveyor, pushing it up the inclined bottom, which is known as the uptake. The uptake is then partly thrown over the top of the coal uptake to be conveyed by the third conveyor, and partly pushed to the fire surface. This process is repeated by the succeeding conveyors. The conveyors are set so that each succeeding 1 will take a certain proportion of the coal conveyed to it, leaving the remainder to be pushed to the fire surface. This proportion is constant, no matter how fast or slow the coal is fed.

The portion of the coal in the course of being pushed to the fire surface is gradually heated and ignited and thereby formed into coke. The process being continuous, piles above the magazine the coke, which partly through gravity, and partly through the action of the conveyors, falls to the inclining grates on the sides, and is gradually worked to the center and the sides of the furnace. The continuous oscillating motion of the conveyors gives a breathing motion to the fire bed, keeping it open for the free circulation of air, and doing away with the slice bar. In the center and the sides of the furnace, the grates are made to shake at the will of the fireman.

The conveyors of each magazine are operated by arms and rods connected to 2 eccentrics secured to a shaft in front of the boiler, called the stoker shaft. This shaft is driven by an engine placed at right angles to it, at the side of the boiler, connected through a reducing worm and spur gears.

The principle of feeding the coal continuously into the furnace below the fire, and the lifting effect of the conveyors, does away with the opening of the furnace doors for firing and slicing the fires. This saves the boiler and furnace from the objectionable inrush of cold air, and therefore eliminates smoke and the destructive gases, maintaining a uniform condition in the furnace and the boiler. The advantages claimed for this stoker are: Simplicity of construction; the fuel is fed automatically; smokeless combustion is attained and a saving of fuel. As the fire doors are not opened, the severe strains of unequal expansion and contraction, caused by the inrushing cold air, are avoided.

Should the stoker be crippled at any time, the boiler can be fired by hand.

E. J. Codd Co., 700 S. Caroline St., Baltimore, Md., make these grates.

A GOOD IDEA

Herewith is shown one of the latest ideas in fibrous packing, the 3-break joint feature of Belmont expansion packing, manufactured by the Clement Restein Co., Philadelphia, Pa. This packing is patented, and is the only packing so constructed. It consists of a casing constructed with rubber back and rubber fibrous sides and holding within its channel 2 sliding wedges.

When the ring is to be placed in position, the ends of 1 wedge are drawn ahead of the ends of the casing, and the ends of the other wedge drawn back, so that the relative position of the 6 ends is as shown in the cut of the open ring.

When placed in position on the rod the 3 breaks occur at different points around the circumference of the rod, as shown in Fig. 2, the cut of the closed ring. So far as the escape of steam through the breaks in the ring is concerned therefore, 1 ring of Belmont expansion packing will take the place of 3 ordinary

FIG. I. BELMONT PACKING RING OPEN

rings, and it is for this reason of especial value for use in shallow stuffing boxes which will not hold more than 1 or 2 rings.

Under gland pressure the sides of the casing are drawn together, and they in turn squeeze the wedges tightly against the wearing surface, making a perfectly tight packing with the minimum of friction. A further advantage of these wedges is that they permit 60 per cent draw as against 10 per cent in other ring packings.

FIG. 2. CLOSED RING OF BELMONT PACKING

The makers guarantee that the materials used in the manufacture of Belmont expansion packings are the best obtainable, and that it will give perfect service under pressures of less than 120 lb. The Clement Restein Co. manufactures a special high pressure packing the use of which is to be preferred for pressures exceeding that figure.

METALLIC PACKING PATENTS

In the field of metallic packings of the ring form the Holmes Metallic Packing Co., of Wilkesbarre, Pa., is one of the pioneers and holds patents on many special features of construction. This company is doing a big business and has a splendidly equipped factory for the sole manufacture of metallic packings, where visitors are always welcome and a box of good cigars is always open. The company is glad to open up every department of the factory to inspection and

it has nothing to conceal except the combination of the safe. The management does not, however, propose to have its patents infringed and is taking steps to protect its rights against all cases where infringement is occurring and proposes to collect royalty wherever such infringement is shown.

Every packing which leaves the Holmes factory, from ½-in. up to 16-in., has the name, patent number and shop number plainly stamped on the end of each case, so that where these markings are found the benefit of the Holmes patents is assured. Not only in the matter of patent rights, but in the matter of quality is the Holmes name on the packing a guarantee of good faith.

WRIGHT WRENCHES

These are made, as shown in Fig. 1 with quick acting ratchet adjustment, controlled by 1 hand. The main jaw and shank are in one piece, a fillet being left in the larger sizes to back up the main jaw and give added strength.

The rack is inserted, leaving a shoulder on each side to form a seat for the sliding jaw, and protecting the rack.

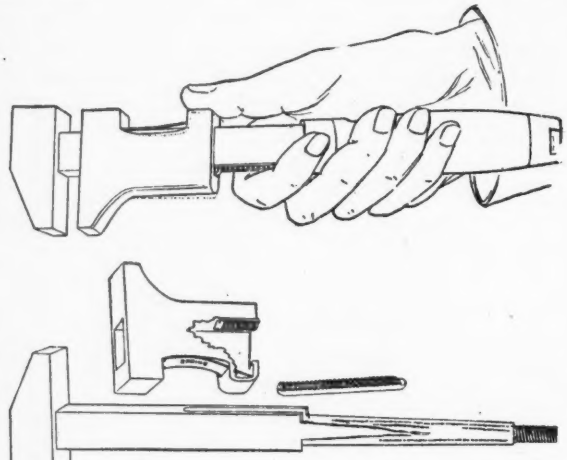


FIG. 1. CONSTRUCTION OF WRIGHT WRENCH

All parts are made interchangeable so that any part can be renewed, but the wrench is so proportioned that the rack is the breaking piece and that can be replaced at slight expense.

In a test recently made of 11 wrenches the results were as shown on Fig. 2. The wrenches were all 12-in. and were tested with a 7-in. leverage; they were in working position with direct forward pull, gripping a 1.5-in. square iron and with the pull increased 200 lb. at a time.

No. 1 gave way by fracture of the movable jaw and the handle coming loose at 2950 lb. No. 2 fractured the stud at the rivet hole at 1600 lb. the jaws being allright. No. 3 had the lower jaw not workable and the handle loose at 2940 lb. No. 4 had the thumb screw out of order at 2400 lb. No. 5 had the jaws inoperative at 3800 lb. and at 3900 lb. the movable jaw broke and the handle came loose. No 6 had the jaws inoperative at 1800 lb. and the lower jaw badly bent. No. 7 had the jaws inoperative at 1800 lb. and the jaw fractured. No. 8 which was a Wright held up to operative condition until the load reached 2600 lb., when the rachet gave out. In No. 9 the jaws were inoperative at 2000 lb. No. 10 also gave out at 2000 lb. from fracture of the movable jaw. No. 11 fractured in the handle near the movable jaw at 3800 lb.

FIG. 2. WRENCHES BROKEN IN TESTING

In all except the Wright, the wrench after fracture was worthless, while the Wright, by putting in a new ratchet and handle could be made as good as new in 3 min. time and at a cost of a few cents.

The value as a time saver is shown by a test by an engineer of the Northern Pacific Railroad who, using the wrench with 1 hand and the torch with the other went over his engine in 1/3 the time that it took with a screw adjustment wrench.

This tool is made by the Wright Wrench Co., of Philadelphia, Pa., in 10 and 12-in. sizes and will soon be made in 6 and 8 in..

NOT LONG SINCE an expert from one of the big electric companies traveled 400 miles on a hurry up call from a new central station to fix the switchboard ground detector, which would not operate. He cut the string which tied the pointer to prevent swinging during shipment,—and went home.

A NEW SUPERHEATER

In selecting a superheater, the points to be considered are proper location to get the best superheating effect, accessibility for cleaning and repairs, safety and durability. In order to get the proper superheating, it should be remembered that the rate of absorption of heat in a superheater depends upon the difference in temperature between the hot gases and the steam. If this difference is small, a larger amount of absorbing surface will be required than if the difference be large.

This determines that the proper location for the superheater is where the gases are as near furnace temperature as practicable. It is also desirable that the apparatus should be arranged with some means of controlling the temperature of steam which demands

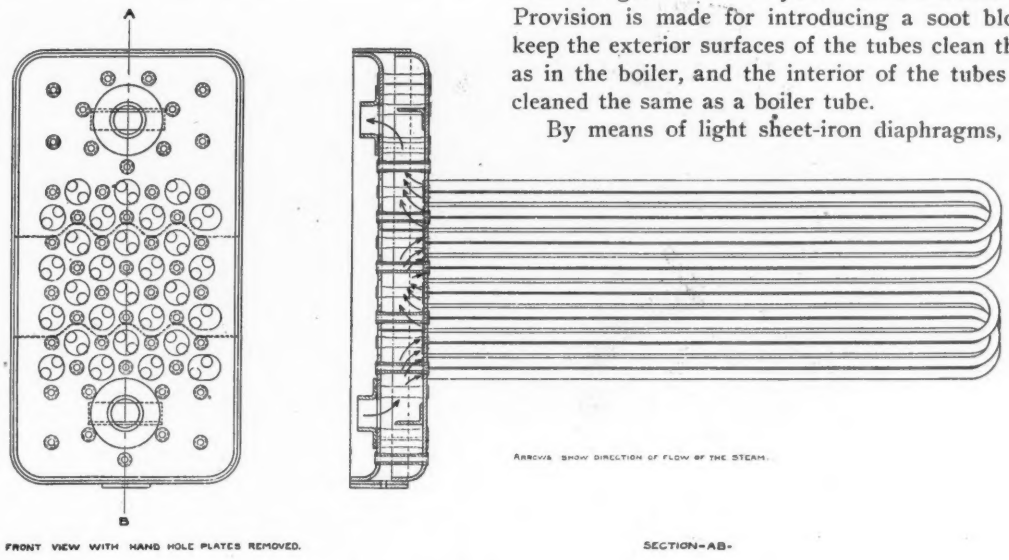


FIG. I. DETAIL OF HEINE SUPERHEATER

that there shall be some way of regulating the quantity of the hot gases passing over the superheater surface. For this reason the superheater must be placed somewhere besides in the direct path of the boiler gases.

Where solid fuels are used, more or less soot and dust will collect on the superheater surfaces, and in order to keep up high efficiency these must be removed. Easy removal calls for smooth surfaces and for the location of the superheater so that all surfaces can readily be reached without making extensive openings into the setting.

If flooding is never resorted to, there will be no deposit on the interior of the superheater tubes; but if flooding is ever necessary, a gradual deposit will result from the water and this unless removed will result, in the course of time, in burned tubes and an expensive repair bill.

Because the boiler plant, and the superheater in particular, are given the most severe treatment of any part of the plant, the superheater should be constructed only of such material and in such a way that it will resist as far as possible the action of varying temperature and of high temperature.

In the superheater now being placed on the market by the Heine Safety Boiler Co., of St. Louis, a header box is used, of practically the same construction as the waterleg used in the Heine boiler. Into 1 side of this header box U tubes made of 1.5-in. seamless drawn mild steel tubing are expanded into holes provided for them. On the opposite side of the header box in the other sheet are handholes closed by inside plates which thus give access to the interior of the whole apparatus.

Hollow staybolts hold the two flange steel sheets of the box parallel and are designed of the same size and strength as the staybolts in the boiler proper. Provision is made for introducing a soot blower to keep the exterior surfaces of the tubes clean the same as in the boiler, and the interior of the tubes can be cleaned the same as a boiler tube.

By means of light sheet-iron diaphragms, the interior of the header box is divided into 3 compartments, thus causing the steam to pass back and forth through the tubes as indicated in Fig. 1.

The superheater is placed at the side of the steam drum, near the front and near the last passage of the boiler gases. It is supported by special castings, which rest upon the boiler setting, and is covered in with a special brick wall. If a high degree of superheat is required, the device may be double, 1 part placed on each side of the boiler shell.

A small flue built in the side wall of the setting carries the hot gases directly from the furnace into the superheater chamber, where they make 2 passes around the superheater tubes and then go to the uptake. The flow of these gases is controlled by means of a damper at the outlet which, when closed, stops the circulation entirely and causes the apparatus to deliver only saturated steam. By varying the opening of the damper, any degree of superheat required can be secured. Steam enters the superheater at the bottom

compartment, passes through the lower row of tubes into the middle compartment and from this through the upper section of tubes into the upper compartment, from which it is carried to the steam main.

As the regulating damper is small and easily operated, thermostatic control of the degree of superheat can be secured if desired.

THE REILLY FEED WATER HEATER

These heaters long used for marine service with excellent results, have lately been offered for land service as well, and have many advantages.

The tubes of this heater are coiled, and secured between manifolds by ground union joints, a construction which prevents the strains from unequal expansion of straight tubes, and which permits of the ready removal of 1 or more coils as required for cleaning or inspection of the heater. The feature of all Reilly heaters of moderate and large size, is the provision of an opening with a large cover, in the side of the shell, through which access may readily be had to the interior, and the coils removed or examined at pleasure.

This construction is new and should be appreciated by all practical engineers.

The advantages of the heater, are the employment of seamless drawn copper coils for heating surface, each coil being secured between manifolds by ground union joints. Coils can be examined or exchanged without disturbing pipe joints. The line of sizes extensive enough to cover all wants from the smallest plant requiring a heater to the largest power station. In the small sizes, cast-iron shells are employed, though steel shells can be furnished at slightly increased cost if preferred and provision is made for passing the entire exhaust of the engines through the heater.

For large plants, where the main engines are usually run, condensing the exhaust from auxiliaries is generally employed for heating feed water, and for such plants the larger sizes of heaters are provided, with openings suitable for receiving the exhaust of auxiliaries only.

The efficiency of the Reilly heater is remarkable, the temperature of feed being usually brought to within 2 or 3 degrees of that of the exhaust steam, because the multicoil heaters employ coils of comparatively small number but of great length, thus giving few joints of tubes and large heating surface.

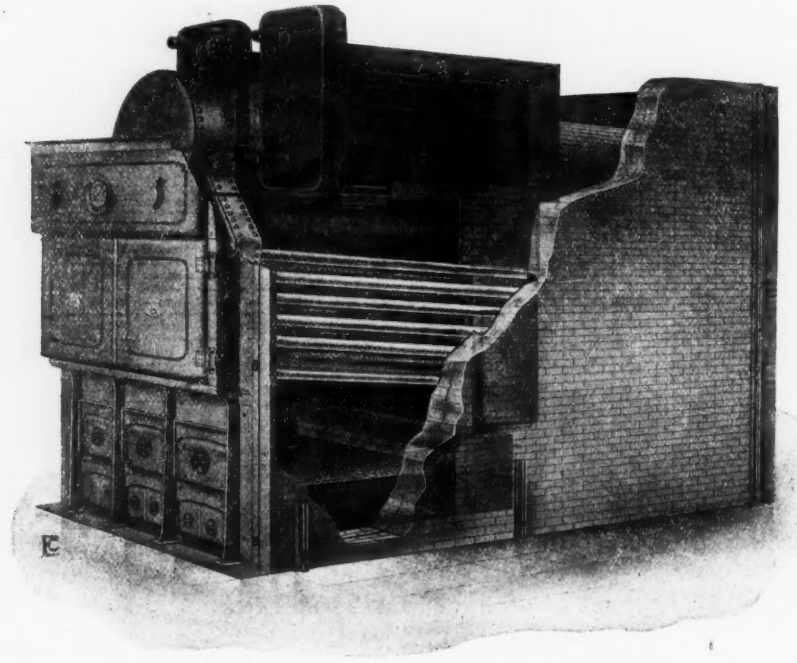


FIG. 2. HEINE SUPERHEATER AS ATTACHED TO BOILER

This heater is made by the Griscom-Spencer Co., 90 West Street, New York City.

CORRECTION NOTE

We have learned that through inadvertence an incorrect statement was published in the August issue in regard to the condenser equipment of the Brunot Island plant described on Page 40. In the paragraph headed "Condensers," statement was made, that a Wheeler condenser is used with the smaller unit. We are informed by the Alberger Condenser Co. that its condensers are in use for all the units in this station, and also that the dry air pump, Fig. 7, Page 44, August 1, is of the Alberger make, as is the centrifugal jet condenser shown in Fig. 5, Page 43. The statements were made in good faith on our part and we are glad to take this opportunity of making correction.

NEWS NOTES

ANNOUNCEMENT IS MADE by the National Battery Co., of Buffalo, that the receivership under which this company has been operating since last February, was terminated Aug. 19. All claims against the National Battery Co. have been settled and the entire property has been restored to the stockholders.

It is also stated that full control of the reorganized company has been secured by The Cutler-Hammer Mfg. Co., of Milwaukee, makers of battery charging rheostats and other electric controlling devices.

The plant of the National Battery Co. will remain at Buffalo, but the business will be conducted under new management and with ample capital.

THE INDUSTRIAL POWER CO., of Milwaukee, Wis.; manufacturers of the Atkinson automatic gas producers, has been sold to a recently organized Wisconsin corporation called the Industrial Gas Power Co., with offices 621-622 Caswell Block. The officers of the new company are W. O. Jones, president and treasurer; C. J. Atkinson, vice president, and H. K. Cowen, assistant treasurer and secretary.

Mr. Jones was, for a number of years, vice president and purchasing agent of the Plano Manufacturing Co., and after the organization of the International Harvester Co., of which the Plano concern was one of the original 5 constituent companies, he was made general manager of the purchasing department. Both Messrs. Atkinson and Cowen have been connected with the Industrial Power Co. since its organization. The Industrial Gas Power Co. will continue to manufacture the Atkinson gas producers, of which there are a large number in successful operation at the present time.

THE SCHAEFFER & BUDENBERG CO., Germany, has sold its plant at Foxboro, Mass., to The Industrial Instrument Co., which was lately organized with Bennett B. Bristol, formerly of the Bristol Co., Waterbury, manufacturer of recording instruments, as its head. The Standard Gauge Mfg. Co. will operate the plant for the manufacture of gages, recording instruments, etc., and the property will be deeded to this company by The Industrial Instrument Co., as the same interests control both concerns.

Watson E. Goodyear, Naugatuck, Conn., will be president of The Standard Gauge Mfg. Co.; Bennet B. Bristol, treasurer, and Arthur F. Mundy, Syracuse, N. Y., secretary.

The plant is modern and well-equipped with 2 main buildings of brick, 60 by 210 ft. each, and a foundry 60 by 150 ft., which was added a few years ago at a cost of $20,000. No extensive orders for equipment will be placed at once, but different machine tools will be ordered as required.

THE COMPLETED EQUIPMENT of the new power house station for the Torrington Woolen Co., Torrington, Conn., which is to be furnished in accordance with plans and specifications by Chas. T. Main, engineer, Boston, will consist of 3 72-in. Bigelow horizontal return-tubular boilers, a feed-water heater, and an auxiliary heater arranged for connection to a future economizer, a 19 by 36-in. Cooper-Corliss horizontal simple noncondensing engine, direct connected to a 250-kw. Crocker-Wheeler alternating-current generator. No piping will appear in the engine room, all steam being taken from below the floor. The economizer when installed will heat water for manufacturing purposes, a tank being provided in the dye house and the system so arranged that the water will circulate through the economizer and be stored in the tank.

YOUTHFUL EXUBERANCE IN THE WHOLE FACTORY FORCE of the Dodge Manufacturing Co.—everybody being young on that day—finds free expression in the field day outing held annually under the auspices of the Dodge Club. August 15 was the date, and beautiful Lake Maxinkuckee the place chosen for the 1908 outing, the second annual. Employes of all departments of the great Dodge works, with relatives and friends to make up a total of more than a thousand, were taken in 2 special trains direct from Mishawaka to the lake, about 40 miles to the southward. In addition to the general pastimes of boating, bathing, fishing and other diversions of a big family picnic, there was a program of field events, consisting of races, contests, water fight games etc., in which many were entered and from which much amusement was derived. The Dodge company met all expenses of transportation bands, orchestra, and other general features of the undertaking.

OIL BURNING LOCOMOTIVES are now employed in two of the Pennsylvania Anthracite Coal Mines for the hauling of the coal trains from the working headings to the shaft.

WILLIAM H. BERRY, JR.

After an illness of only 10 days, William H. Berry, Jr., treasurer of the Berry Engineering Co., of Chester, Pa., and the trusted representative of his father, who is the president of the company, died of a complication of typhoid and brain fever on Aug. 24. Mr. Berry was only 22 years of age, but had for some time been looking after his father's private interests in the manufacturing line, and had devoted himself so persistently to his work that nervous exhaustion succeeding an attack of typhoid fever brought on brain fever, from which he was unable to rally.

Mr. Berry graduated from the commercial department of the Chester city schools and afterward from the engineering department of Drexel Institute, Philadelphia. Since taking up work in his father's company, he has shown remarkable talent for business and has been prominent in the public life of the city. His parents and 3 brothers survive him.

SOCIETIES

THE SEASON OF PROFESSIONAL MEETINGS of The American Society of Mechanical Engineers will be opened on Tuesday evening, Oct. 13, by a meeting of the Gas Power section in the Engineering Societies Building at 29 West 39th Street, New York. H. L. Doherty, chairman of the meetings committee of the section, will present a report for discussion outlining plans for future work and there will also be a discussion of standards to be used in gas power work. Two papers will be read, one by E. A. Harvey on gas producer plants, with data upon costs, performance, etc.; and one by N. T. Harrington, giving the results of tests to determine the loss of fuel weight in a freshly charged producer, due to increase of ash content in the fuel bed.

THE SEVENTH ANNUAL OUTING of the V. D. Anderson Club took place on Sunday, Sept. 6. Leaving Boston on the steamer Governor Andrews, Bass Point, Nahant, was reached about noon, and the party walked in line to the Relay House, where a sumptuous shore dinner was served. Speechmaking, toasts and good cigars followed, then the members and guests were ready for the event of the day. The party boarded the splendid gasoline launch, Coming, which, together with the Clementi orchestra, had been engaged for the occasion, and enjoyed a fine sail down Boston Harbor. Relanding at Nahant a visit was made to the Rustic theatre, after which the entire party was photographed. Boston was reached about 9 p. m., the moonlight sail up the harbor being particularly enjoyable. The grand success of the outing was due to the untiring efforts of L. A. Couch, New England representative of the V. D. Anderson Co., Cleveland, Ohio, and William Paul, chief engineer of the Northeast Structural Works, East Everett, Mass. Singing of Auld Lang Syne by the party, accompanied by the orchestra, brought a well-spent day to a fitting close.

THE MODERN SCIENCE CLUB, of Brooklyn, N. Y., opened its winter season at the club house, 125 South Elliott Place, Brooklyn, with a smoker and entertainment on Tuesday evening, Sept. 29. The following announcements were made for the first month of its lecture course: Oct. 6, Almet R. Latson, president of the Union League Club of Brooklyn, will deliver an address on The Source of Our Law; Oct. 13, quarterly meeting of the club; Oct. 20, Emil F. Gennert, superintendent of the Manhattan Brass Co., subject Voting Machines; Oct. 27, George A. Orrok, mechanical engineer of the New York Edison Co., subject Central Station Design. The club house is always open on lecture nights to those interested in engineering and allied lines.

JOHN A. CARSON, better known as "Jack" Carson, announces his connection with the James Smith Packing Co., of Philadelphia, in the capacity of manager of sales. Carson and the packing business are inseparable and his 21 years' connection with the A. W. Chesterton Co. has built up a wide acquaintance among the general trade.

THE HOPPES MANUFACTURING CO., whose main office and works are at Springfield, Ohio, has recently removed its New York office, in charge of Mr. C. E. Ware, from the Havemyer Bldg. to new quarters in the Singer Bldg., 149 Broadway.

BOOKS AND BOOKLETS

THE FIRST EDITION having become exhausted, the Underfeed Stoker Co. of America, Chicago, Ill., has just issued a second and revised edition of its attractive pocket catalog, which is now ready for distribution. It contains a fund of valuable information and statistics about the Jones stoker and is illustrated with fine half-tones and line drawings, showing complete stoker installation and various parts of the apparatus. Copies may be obtained on request.

HENDRICK'S COMMERCIAL REGISTER OF THE UNITED STATES is one of the most complete and important trade lists published in the country. The 1908 edition shows improvement and enlargement over that of the previous year, the amount of the growth being shown by the fact that for 1908, 82 pages are required for the index, while for 1907, 76 pages were sufficient. In this index are included a total of 33,684 classified trade headings, each one representing manufacturers of some kind of machine, tool, specialty or material. The entire register numbers over 1300 pages and contains more than 350,000 names and addresses. It covers, engineering, mechanical, railroad, electrical, mining, iron, steel, export and kindred industries, and is so arranged that it can be used either for purchasing or mailing purposes. For instance, under the heading of Machinists and Founders, all firms having machine shop or foundry are classified for mailing purposes, then each firm is subclassified under headings covering its product. Care is taken to revise the list each year, both for names and addresses, so that it is kept as nearly correct as possible. It is put up in substantial cloth binding, and is printed on a light but tough paper. The price is $10, express charges prepaid, published by Samuel E. Hendricks Co., 74 Lafayette St., New York City.

ELECTRICAL CONTRACTING, by Louis J. Auerbacher. New York, 1908, 150 pages, illustrated, cloth $2.

In this book have been collected many hints for wiremen and contractors which will be found of practical use. Methods of installing cleat and conduit work, outdoor circuits and special apparatus are given in detail. Shop system, estimating methods of connection, putting in lights, motors, dynamos, bells, and special devices are covered in the several chapters. It is easy to understand and full of meat.

GOULDS LIFT AND FORCE PUMPS for hand and wind-mill power are described in a folder sent out by the Goulds Mfg. Co., of Seneca Falls, N. Y. These are adapted for wells of moderate or great depth up to 125 ft.

LIBERTY GREENAWAY SEPARATORS for steam, oil, ammonia and air, are fully described in Bulletin No. 50, just issued by the Liberty Mfg. Co., of Pittsburg, Pa. For each type of separator a sectional view is given showing the construction and method of operation, also a full list of dimensions and price list. Besides these separators the Liberty Co. manufactures the Twin strainer, the Liberty tube cleaner, the Faber blowoff valve, Liberty feed-water regulator, and the Liberty lubricating system.

THE SYMBOL OF DURABILITY is the title of an attractive pamphlet sent out by the B. F. Sturtevant Co., of Hyde Park, Mass. This describes a new device for making the joints at the ends of the Sturtevant economizer which has a number of advantages. These are fully set forth in the pamphlet, which can be had on request.

THE CLEMENT RESTEIN CO., Philadelphia, manufacturer of Belmont Packings, Gaskets, and Hose, has just issued a new catalog, 120 pages and cover, which calls particular attention to the fact that a specialty of the company is the making of packings for all kinds of unusual purposes, for which it is well equipped.

STEAM ENGINE INDICATORS is a subject always of interest to the power plant engineer, for the indicator is his most effective tool in securing engine economy. Information about the indicator is important, and every engineer is anxious to have it. In a booklet of 70 pages just issued by the American Steam Gauge & Valve Mfg. Co., Boston, not only is the American Thompson Improved Indicator fully described and illustrated, the method of handling it given in detail and the methods employed in manufacturing and testing it fully described, but also instructions are given for the use and care of the indicator, for reading the diagram, drawing the theoretical curve and what it is used for, and a complete steam table. This booklet may be had on application.

DETROIT STOKER & FOUNDRY CO. is issuing a beautiful catalog describing its new automatic stoker. This gives elevations and sectional views and details of construction of the stoker, showing, also, its application to various kinds of boilers. In the catalog are also included tables of evaporation per boiler horsepower at various feed-water temperatures and steam pressures, factors of evaporation, the rating of tubular boilers, horsepower of chimneys, and a number of illustrations of installations.

STEPHENSON MFG. CO., of Albany, is sending to its friends an attractive series of calendars, the first being for the month of September. Anybody who likes a handsome wall ornament will be pleased at the result if he sends a postal to the Stephenson Mfg. Co., Albany, N. Y.

FOR THOSE INTERESTED IN REFRIGERATION the new Catalog No. 20 issued by the Arctic Ice Machine Co., of Canton, Ohio, on the subject of Ammonia Fittings and Supplies, is well worth possessing. The different styles of fittings and valves are shown, special fittings such as drain heads, return bends and oil traps being included. Ammonia condensers are also described and details of different kinds of coils. The whole book is a handsome piece of printer's work, with a particularly attractive embossed cover and contains 150 pages, of which 30 pages are given up to valuable tables of data.

TRADE NOTES

THE VALLEY IRON WORKS is sending out to its friends a handsome and substantially made watch fob illustrating the Lycoming engine embossed in a panel on a pleasing scroll design. In its good appearance and durable makeup the fob creditably represents the product of the Valley Iron Works and will be a valued companion of those who receive it.

ABOUT 2 YEARS AGO the F. S. Walton Co. placed on the market a new belt dressing, under the name of Ox-Oil-Ox, the base ingredient of which is pure neatsfoot oil, pressed and refined from the finest hoof stock obtainable. It has already reached a wide sale by sheer force of merit. Being made from the hoofs of cattle, while the belt is made from the hide, it is a natural product that cannot by any means harm the leather, and the manufacturers claim it puts back into the belt practically all the natural strength and vitality lost in tanning the rawhide. However that may be, the theory is a good one, and judging from the bunch of testimonial letters they send in from prominent firms it is proving exactly what they claim —that it puts life into old and practically worn out belts, making them limber up and run slack, where before they had been tight as the proverbial drum. Of interest to readers is the fact that a sample can may be had free by addressing the manufacturers direct.

KEUFFEL & ESSER CO. is offering to those who have occasion to do block lettering a new style of pen with ink reservoir. This comes in 6 different widths of line and gives an absolutely uniform and even letter, saving time and giving a good looking result.

AMONG RECENT ORDERS taken by The Ohio Blower Co., Cleveland, Ohio, for its Swartwout cast-iron exhaust heads are the following: 1 16-in. to Indiana State Reformatory, Jeffersonville, Ind.; 1 14-in. to Hanover Light, Heat & Power Co., Hanover, Pa.; 1 12-in. to Brown Cracker & Candy Co., Dallas, Tex.; Hughes High School, Cincinnati, Ohio, 1 8-in.; Home Insurance Building, Chicago, Ill., 1 8-in.; 1 7-in. to Eastman-Gardiner & Co., Laurel, Miss.; 1 6-in. to International Milk Products Co., Cooperstown, N. Y.; 2 5-in. to La Crosse Plow Co., La Crosse, Wis.; 1 5-in. to Madisonville High School, Madisonville, Ohio; 1 5-in. to Philip Vogelmeier, Newark, Ohio; 1 5-in. to Kibbe Bros. Co., Boston, Mass.; and others to High School Building, Auburn, N. Y.; Speed Changing Pulley Co., Anderson, Ind.; Williams & Bangs, Boston, Mass.; L. C. Egbert, New Carlisle, Ind.; Central Machine Works, Lancaster, Pa.; Cahill-Swift Mfg. Co., St. Louis, Mo. Also Swartwout steam separators to the following: 1 10-in. and 1 6-in. to Roden Coal Co., Marvel, Ala.; 1 7-in. to Crenshaw Oil Co., Crenshaw, Miss.; 2 6-in. to Cleveland Furnace Co., Cleveland, Ohio; The Pittsburg-Belmont Coal Co., Lafferty, Ohio, 1 6-in.; and others to Oakland Machine Works, San Francisco, Cal.; Speed Changing Pulley Co., Anderson, Ind.; Federal Manufacturing Co., Erie, Pa.; Ranney Refrigerator Co., Greenville, Mich.; Virginia Carolina Chemical Co., Chicora Works, Charleston, S. C.

A BRILLIANT RECORD has been made by the pumps installed in the 39th Street Pumping Station, Chicago, by the Allis-Chalmers Co. Not many years ago 2,000,000,000 gal. of water and sewage pumped through 1 station in a single day would have seemed impossible, but a capacity of 160,000,000 gal. in excess of this has been provided for jointly by the sanitary district of Chicago and the municipality of Chicago at this station. The 39th Street station is only one of several, all of which are equipped with units built by the Allis-Chalmers Co. A complete description of this station and illustrations of the centrifugal pumps and other apparatus installed are given in the Allis-Chalmers Bulletin No. 1611, a copy of which can be had on application.

M. R. FRANCE, secretary of the France Co., of Bloomville, Ohio, writing to the Buckeye Boiler Skimmer Co., of Toledo, gives the following testimony as to the effectiveness of its apparatus:

"With reference to yours of the 20th inst. relative to our experience with the Buckeye automatic boiler cleaner, wish to state that we have had your skimmers in service at all of our crushing plants during the last few years, and the results obtained from their usage are very satisfactory. We operate them several times a day and thus remove the scale and other sediment before it has had time to adhere to the boiler.

"We take pleasure in recommending the Buckeye skimmer to any company operating boilers where the water used contains enough scale forming matter or other sediment to corrode the iron, as we consider

such corrosion not only very destructive but very expensive to remove when once formed. For this reason we believe it good economy to invest in some appliance as this boiler cleaner, which will prevent, so far as possible, such scale formation.

"Wishing you success in the sale of the Buckeye automatic cleaner."

WRITING TO THE Martin Grate Co., of Chicago, P. J. Sheehan, superintendent of the Niles Fire Brick Co., Niles, Ohio, says: "The grates are giving perfect satisfaction and are very economical in the matter of fuel, and they assist us in getting increased efficiency from our boilers. They certainly get all there is in the fuel as an inspection of our ash pile will bear out."

YORK MFG. CO., of York, Pa., has had a good month's business and reports among recent sales the following: Lewis Russ, Philipsburg, Pa., 10-ton compression side, single acting, 2-ton freezing system, and piping for storage rooms; New England Fish Co., Ketchikan, Alaska, 2 65-ton refrigerating machines, 20-ton ice making plant, and piping for complete fish freezing plant; Mary-Elizabeth Candy Co., Syracuse, N. Y., 1.25-ton refrigerating plant; Illinois Soldiers' and Sailors' Home, Quincy, Ill., 20-ton horizontal compression side, 2-ton freezing system and piping for storage rooms; Fort Wayne Hotel Co., Fort Wayne, Ind., 20-ton horizontal refrigerating machine and plant for the Anthony Hotel, Fort Wayne, Ind.; Hedden Construction Co., New York, N. Y., 20-ton horizontal refrigerating machine, 10-ton freezing system and water cooling plant for the Metropolitan Life Insurance Building, New York; Valvoline Oil Co., Warren, Pa., 1 40-ton refrigerating plant; Toledo Furnace Co., Cleveland, Ohio, 3 300-ton cross-compound, vertical, single-acting, refrigerating machines, ammonia condensers and brine coolers for dry blast plant; Huff & Chini, Flushing, Ohio, 1 6-ton ice making plant; Elbe & Ratzloff, Taloga, Okla., 1 complete 5-ton ice making plant; Jellico Ice Co., Jellico, Tenn., 40-ton compression side, single acting; W. W. Aimar & Co., Savannah, Ga., 1 30-ton compression side, single acting; Frederick Loeser Co., Brooklyn, N. Y., 1 50-ton absorption type refrigerating machine for fur storage.

THE CHERRY CHEMICAL CO., manufacturers of the Red Seal boiler compound, desires to secure agents to represent it. This company is meeting with remarkable success, and we are sure that if any bright active man desires to become agent for a bright, active company, he will be making no mistake in writing to the Cherry Chemical Co., 1018 Callowhill Street, Philadelphia, Pa.

WANTED

"Positions Wanted" advertisements not exceeding 50 words for subscribers to Practical Engineer will be inserted twice free of charge. "Help Wanted" and special advertisements 25 cents a line.

POSITION

As engineer. Have had twenty years' experience, understand all kinds of engines and can do all manner of pipe fitting and electric wiring. Will accept a good first position of firing or as second engineer. Address Box 84, care of Practical Engineer. 9-2

POSITION

By engineer with first-class Massachusett's state license. Am also a first-class machinist. Capable and conscientious worker. West or southwest preferred. Address Box 86, care of Practical Engineer. 9-1

WANTED

Salesmen to sell 10 years' established pulley covering, also engine room specialty, in every city in U. S. A customer recently wrote, "Your pulley cover has reduced our belt troubles 75 per cent." Liberal commission to men who can sell things. In writing give experience and line now selling, if any. Address Box 85, care of Practical Engineer. 9-1

PATENTS

Watson E. Coleman, Patent Attorney, Washington, D. C. Advice and books free. Highest references. Best services. 4 tf

WANTED

Engineers, Firemen, Electricians, Machinists, etc. New 25-page pamphlet containing questions asked by Examining Boards sent free upon request. Address, Geo. A. Zeller Book Co., 4467 W. Belle Place, St. Louis, Mo. Established 1870. 4 tf

ENGINEERS AND MECHANICS

to make big money selling Incomparable "Dozit" Hand Soap. A 10-cent can will instantly remove more dirt and stains from the hands than four cakes of any soap made, and it will not injure the most delicate skin. Small sample free. Byram Co., 225 Congress Street, Boston, Mass. 4 tf

FOR ENGINEERS

The new revised edition of the Modern Engineer's Hand Book. A $2.50 Book by mail on receipt of 50 cents. Be quick. Address, W. H. Ermentrout, 514 Elm Street, Reading, Pa. 4 tf

PATENTS

C. L. Parker, Late Examiner, U. S. Patent Office, Attorney-at-Law and Solicitor of Patents. Patents secured promptly and with special regard to the legal protection of the invention. Handbook for inventors sent upon request. 186 Dietz Bldg. Washington, D. C. 4 tf

FOR SALE

60 steel storage tanks, 6,000 gallons' capacity. Good as new. Double riveted, extra well built. Suitable for storage of oils, waters or liquids of any kind. 100 steam pumps. Get our prices on engines, boilers and electrical machinery. All sizes and kinds. Chicago House Wrecking Co., 35th and Iron Sts., Chicago. 4 tf

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We want a good Salesman in every city in the United States, to handle Ideal Metallic Packing. Manufacturers' Agents and Engineers preferred—Ideal Metallic Packing Co., South Stillwater, Minn. 4 tf

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Engineer of mill, power or refrigeration plant is open for a position. Will go anywhere. Address Engineer, P. O. Box 527, Berlin, N. H. 8-2

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As assistant engineer by a young man, 23, Ohio license. Six years' experience with all kinds of boilers, engines and electrical equipment. Employed at present in 2000 hp. light and power plant. Will go anywhere, distance no objection. Can furnish references. Address Box 83, care of Practical Engineer. 8-2

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To exchange postal cards with fellow engineers and firemen. Address J. T. Baker, 132 S. Gage St., Los Angeles, Cal. 9-1

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As assistant in electric light plant. Graduate of I. C. S. electric lighting and engine running courses. Experienced in care and operation of storage batteries. About two years' experience in light plant work. Best references as to character and ability. Address Sam Frost, Odessa, Mo. 8-2

NOTICE TO ENGINEERS

If you are desirous of making a change we offer the best opportunity for a nice income to the right man. The best selling specialty for a boiler extant. Selling for $50.00 each. A necessity to every boiler. Liberal contract. Address Power Specialty Co., 236-C Fort St., W., Detroit, Mich. 9-1

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which can be used in machine shop, boiler room or engine room. Must have merit. We possess finest facilities for marketing, having a large force of traveling men in this country and agents in nearly every large city of Europe, who call upon steam users and machine shops. Liberal contract. Highest of references. Address Power Specialty Co., 236 B. Fort St. W., Detroit, Mich. 9-1

STEAM PLANT FOR SALE

22x48 Wetherill Corliss engine. Cost $3350, sell $1500. Two tubular boilers 66 inches by 18 ft. Cost $1000 each, sell $450 each. F. O. B. cars, Chester, Pa. All in good condition. Keppel & Co., Chester, Pa. 9-1